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GEOLOGY, ENERGY AND MINERAL RESOURCES ASSESSMENT OF THE KOFA AREA, ARIZONA

BY

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BUREAU OF LAND MANAGEMENT

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CONTENTS

Summary 1
Introduction. 5
   Purpose, scope, and methodology. 5
   Geological, energy and minerals (GEM) resources area (GRA) 5
   Location and access. 6
Physiography. 7
Geology 10
   Lithostratigraphy-rock units 11
      Older Precambrian rocks 11
      Paleozoic 28
      Mesozoic. 29
      Laramide. 31
      Metamorphic core complexes. 32
      Mid-Tertiary. 33
      Late Tertiary 37
      Latest Tertiary and Quaternary. 38
   Structural geology 38
   Paleontologic documentation. 41
   Geological history and paleogeographic development 43
Energy and mineral resources. 46
   Known mineral deposits, mines or prospects with
      recorded production 47
   Known prospects, mineralized areas, and geothermal
      resources with no recorded production 75
   Mining claims, leases, and material sites. 104
   Mineral deposits types 121
      Older Precambrian igneous and metamorphic rocks 125
      Paleozoic and Mesozoic sediments. 126
      Jurassic arc intrusive rocks. 129
      Laramide intrusive rocks. 130
      Mid-Tertiary metamorphic core complexes 132
      Mid-Tertiary volcanic rocks .133
      Mid-Tertiary basin-fill sediments 137
      Late Tertiary basin-fill sediments. 140
      Recent alluvium 141
      Active geothermal systems 141
   Mineral economics. 141
      Strategic and critical minerals and metals. 153
The geology, energy and mineral resources of the wilderness
   study areas. 156
   Classification scheme. 156
   Level of confidence scheme 157
   Trigo Mountains and South Trigo Mountains WSAs
      (050-023B and 050-023A) 157
      Geology 157
      Mineral deposits. 158
      Land classification for GEM resources potential 159
         Metallic minerals. 159
         Uranium. 161
         Non-metallic minerals. 161
      Recommendations 163
   Kofa Unit 4, Southern Addition WSA (050-034) 165
      Physiography. 165

Geology 165
Mineral deposits. 166
Land classification for GEM resources potential 166
Uranium. 166
Recommendations 167
Kofa Unit 4, Northern Addition WSA (050-033) 167
Physiography. 167
Geology 167
Mineral deposits. 168
Land classifications for GEM resources potential. 168
Recommendations 168
Kofa Unit 3, Southern Addition WSA (050-031) 168
Physiography. 168
Geology 168
Mineral deposits. 169
Land classification for GEM resources potential 169
Recommendations 169
New Water Mountains WSA (020-125). 169
Physiography. 169
Geology 170
Mineral deposits. 171
Land Classification for GEM resources potential 172
Metallic minerals. 172
Uranium. 174
Geothermal 174
Recommendations 177
Little Horn Mountains West WSA (020-126A). 178
Physiography. 178
Geology 178
Mineral deposits. 178
Land classification for GEM resources potential 179
Metallic minerals. 179
Recommendations 179
Little Horn Mountains East WSA (020-127) 179
Physiography. 179
Geology 181
Mineral deposits. 181
Land classification for GEM resources potential 181
Metallic minerals. 181
Uranium. 182
Recommendations 184
Eagle Tail Mountains WSA (020-128) 184
Physiography. 184
Geology 185
Mineral deposits. 185
Land classification for GEM resources potential 186
Metallic minerals. 186
Non-metallic minerals. 187
Recommendations 187
Clanton Well WSA (020-129) 188
Physiography. 188
Geology 189
Mineral deposits. 189
Land classification for GEM resources potential 189
Metallic minerals. 190

Uranium. 190
Geothermal 190
Non-metallic minerals. .190
Recommendations 192
Face Mountain WSA (020-136). 192
Physiography. 192
Geology 194
Mineral deposits. 194
Land classification for GEM resources potential 194
Uranium. 194
Recommendations 195
Signal Mountain WSA (020-138). 195
Physiography. 195
Geology 195
Mineral deposits. 196
Land classification for GEM resources potential 196
Metallic minerals. 196
Recommendations 196
Woolsey Peak WSA (020-142/144) 198
Physiography. 198
Geology 198
Mineral deposits. 198
Land classification for GEM resources potential 198
Metallic minerals. 199
Uranium. 199
Recommendations 199
References. 201

ILLUSTRATIONS

Figure 1: Location of the Cibola, Brenda, Eagle Tail, and Saddle sub-areas of the Kofa GRA. Surface physiography and depth-to-basement contours after Oppenheimer and Sumner (1981).

Figure 2: (Includes Figure 2A, 2B, 2C, and 2D). Paleotectonic and paleogeographic maps of Arizona showing location of the Kofa GRA.

Figure 3: Geologic, energy and mineral resources map of the Cibola sub-area, Arizona.

Figure 4: Geologic, energy and mineral resources map of the Brenda sub-area, Arizona.

Figure 5: Geologic, energy and mineral resources map of the Eagle Tail sub-area, Arizona.

Figure 6: Geologic, energy and mineral resources map of the Saddle sub-area, Arizona.

Figure 7: Legend for geologic, energy and mineral resources maps.

Figure 8. Location of oil and gas exploration holes in southern Arizona.

Figure 9: Claim density map with oil and gas leasing status for for the

Eagle Tail sub-area, Arizona.

Figure 10: Claim density map with oil and gas leasing status for the Brenda sub-area, Arizona.

Figure 11: Claim density map with oil and gas leasing status for the Eagle Tail sub-area, Arizona.

Figure 12: Claim density map with oil and gas leasing status for the Saddle sub-area, Arizona.

Figure 13: Favorability potential and level of confidence map for metallic mineral resources of the Cibola sub-area, Arizona.

Figure 14: Favorability potential and level of confidence map for uranium resources of the Cibola sub-area, Arizona.

Figure 15: Favorability potential and level of confidence map for non-metallic resources of the Cibola sub-area, Arizona.

Figure 16: Favorability potential and level of confidence map for metallic mineral resources of the Brenda sub-area, Arizona.

Figure 17: Favorability potential and level of confidence map for uranium resources of the Brenda sub-area, Arizona.

Figure 18: Favorability potential and level of confidence map for geothermal resources of the Brenda sub-area, Arizona.

Figure 19: Favorability potential and level of confidence map for metallic mineral resources of the Eagle Tail sub-area, Arizona.

Figure 20: Favorability potential and level of confidence map for uranium resources of the Eagle Tail sub-area, Arizona.

Figure 21: Favorability potential and level of confidence map for geothermal resources of the Eagle Tail sub-area, Arizona.

Figure 22: Favorability potential and level of confidence map for non-metallic mineral resources of the Eagle Tail sub-area, Arizona.

Figure 23: Favorability potential and level of confidence map for metallic mineral resources of the Saddle sub-area, Arizona.

Figure 24: Favorability potential and level of confidence map for uranium resources of the Eagle Tail sub-area, Arizona.

TABLES

Table 1: Wilderness study areas in the Kofa GRA.

Table 2: Claim density records in the Wilderness Study Areas "WSA), Cibola sub-area, according to BLM (June 1982), Arizona state office.

Table 3: Claim density records in the Wilderness Study Areas (WSA), Brenda sub-area, accroding to BLM (June 1982), Arizona state office.

Table 4: Claim density records in the Wilderness Study Areas (WSA), Eagle Tail sub-area, according to BLM (June 1982), Arizona state office.

Table 5: Claim density records in the wilderness study areas (WSA), Saddle sub-area, according to BLM (June 1982), Arizona state office.

Table 6: Geological environments of the Kofa area and associated mineral deposit types.

Table 7: List of commodities present in the Kofa GRA; Cibola sub-area.

Table 8: List of commodities present in the Kofa GRA, Brenda and Eagle Tail sub-areas.

Table 9: List of commodities present in the Kofa GRA, Saddle sub-area.

GEOLOGY, ENERGY AND MINERAL RESOURCES ASSESSMENT OF THE KOFA AREA, ARIZONA

by

Jan Krason, Antoni Wodzicki and Susan K. Cruver

SUMMARY

The Kofa "Geological, Energy and Mineral (GEM) Resources Area" (GRA) is located in Yuma and Maricopa counties in southwestern Arizona and in Imperial County in southeastern California, and contains 13 "Wilderness Study Areas" (WSAs). It lies within the Sonoran Desert section of the Basin and Range Province.

Basement consists of Precambrian (1.8-1.7 b.y.B.P.) amphibolite and augen gneiss, and granitic rocks intruded 1.5 to 1.3 b.y.B.P. The basement is unconformably overlain by shallow marine Cambrian sandstones, which in turn are disconformably overlain by Devonian to Permian shallow marine carbonates and sandstones. During the Mesozoic, a magmatic arc extended over most of the GRA and produced intermediate to felsic volcanics and intrusives. Following the magmatic activity, locally evaporite-bearing molasse sediments were deposited. The Paleozoic-Mesozoic sequence was metamorphosed prior to the onset of the Laramide Orogeny, 70 to 50 m.y.B.P. The Laramide was a period of intense tectonic activity, and within the GRA S-type granites were emplaced. During the mid-Tertiary orogeny (35-14 m.y.B.P.), a great thickness of fluvial and lacustrine sediments interbedded with voluminous calc-alkalic volcanics were deposited within northwest-striking basins, and to the north and east of the GRA metamorphic core complexes were emplaced. Basin and Range faulting was dominant between 14-4 m.y.B.P. and was accompanied by basin-fill sedimentation and basaltic volcanism. Since 4 m.y.B.P. the main geologic processes have been erosion and deposition of alluvium.

Potentially favorable host rocks for mineral or energy resources include: Precambrian pegmatites; Mesozoic redbeds and metamorphics; mid-Mesozoic arc intrusives; Laramide intrusive rocks; mid-Tertiary volcanics; mid- and late Tertiary basin-fill sediments; and recent alluvium. Precambrian pegmatites in the Saddle sub-area are enriched in Nb, Ta, Y, U, Th, Ti, Pb and Ag. Mesozoic redbeds in the Brenda sub-area are potentially favorable for the occurrence of redbed copper-silver deposits, though no such occurrences are known. Small scheelite and gold bearing veins in Mesozoic schists in the Brenda sub-area may be related to the pre-Laramide metamorphism of these rocks. Several gold, silver, base metal and iron deposits are peripheral to a mid-Jurassic intrusive in the Brenda sub-area and may be genetically related to it. There are no known porphyry copper occurrences in the GRA, which lies outside the main porphyry copper belts of the southwest. But several replacement and lode deposits of copper, iron and tungsten are associated with a Laramide intrusion in northeastern Brenda sub-area. The majority of the mineral deposits within the GRA are related to mid-Tertiary volcanism and the major districts may be centered around

cauldrons and/or sub-volcanic intrusives. Important districts and mineralized areas include: the Trigo Mining District in the Cibola area from which minor gold and 10,000-20,000 tons of manganese ore have been mined; the Silver and Eureaka Mining District in the Cibola sub-area, from which 1.6 million ounces of silver and lesser gold, lead and zinc have been produced; the Castle Dome Mining District in the Cibola sub-area from which 450,000 ounces of silver and 1.7 million pounds of lead were produced; the north-central part of the Brenda sub-area where fifteen thousand tons of silver and copper ore have been produced; and the west-central part of the Eagle Tail sub-area from which 120,000 tons of gold and silver ore have been produced. Mid- and late Tertiary valley-fill sediments and volcanics contain uranium source rocks, aquifers and reductants. Eight uranium occurrences are present within the GRA, and the rocks are considered favorable for uranium accumulation. Extensive warm (32-49°C) geothermal waters are present in late Tertiary sediments in the Brenda, Eagle Tail and Saddle sub-areas, and could be used to enhance agricultural production. Gold has been mined from placer deposits in the Trigo and Castle Dome Mining Districts, and from along the Colorado River.

The Trigo Mountains and South Trigo Mountains WSAs are underlain by Mesozoic schists and mid-Tertiary volcanics and porphyries. The northern and southern parts of the WSAs are within the Trigo, and Silver and Eureka mining districts and are highly favorable for metallic mineral deposits. The remainder of these WSAs is moderately favorable for metallic minerals.

The Kofa Unit 3 Southern Addition, Kofa Unit 4 Northern Addition and Kofa Unit 4 Southern Addition WSAs are underlain by Tertiary sediments and volcanics. The southern parts of the Kofa Unit 4 Southern Addition is moderately favorable for uranium because of the presence of adequate source rocks, a thick sequence of sediments and a nearby uranium occurrence.

The New Water Mountains WSA is underlain by Precambrian granite, Paleozoic sediments, Mesozoic volcanics, intrusives and redbeds, mid-Tertiary volcanics and late Tertiary valley-fill sediments. The area near the Ramsey Mine in the north-central part of the WSA is highly favorable for the presence of metallic minerals because 8400 tons of ore containing 34 ounces Ag/ton was produced from the mine. The area surrounding the mid-Jurassic intrusive in the western part of the WSA is moderately favorable for metallic mineral deposits because mid-Mesozoic plutons have been considered favorable for porphyry deposits and several small deposits are located near the intrusive contact of the pluton.

The Little Horns Mountains West, Little Horns Mountains East, Eagle Tail Mountains and Clanton Well WSAs are underlain by Precambrian schist and granite, Mesozoic schist, gneiss and granite, Laramide intrusives, mid-Tertiary volcanics and sediments and late Tertiary sediments. The area underlain by Mesozoic rocks in the Eagle Tail WSA is considered to be moderately favorable for metallic deposits because of the presence of several gold and manganese occurrences that could be associated with Mesozoic plutons or mid-Tertiary rhyolitic intrusives. The area underlain by Tertiary volcanics in the northeastern part of the Eagle Tail sub-area is moderately favorable for metallic deposits because of the presence of gold and silver occurences and the nearby presence of a large Tertiry intrusive. The area underlain by Precambrian rocks in the Clanton Well WSA is considered moderately favorable for metallic minerals because of gold, lead and molybdenum occurrences, presence of Tertiary intrusive rocks and because of the possibillity of the occurrence of massive sulfide deposits associated with Precambrian metavolcanics. The area underlain by Tertiary sediments in the southwesten part ofthe Clanton Well WSA is moderately favorable for uranium because of the presence of source rocks, aquifers and reductants and the presence of one uranium occurrence near the WSA boundary. The southern part of the Clanton Well WSA is moderately favorable for geothermal energy because thirteen warm water wells (35-49°C) are present a short distance south of the WSA.

The Face Mountain, Signal Mountain and Woolsey Peak WSAs are underlain by Precambrian schist, gneiss and granite, mid-Tertiary andesite and sediments, and Quaternary-Tertiary basalts. The area underlain by Precambrian granite near the niobium-tantalum occurrences in the southwestern part of the Woolsey Peak WSA is moderately favorable for metallic minerals because of the occurrence of mineralized pegmatites and placers in this area.

Important recommendations for further work in the WSAs include:

1. Field checking for presence of metalliferous zonation in mining districts,
2. Radiometric dating to establish genetic relationships between igneous events and hydrothermal alteration,
3. Check for possible relations between hydrothermal mineralization and mid-Tertiary cauldrons,
4. Mineralized areas with oxide-carbonate-sulfate mineral assemblages should be checked to determine whether they are supergene or hypogene in origin.
5. Uranium solubility index should be calculated for well waters in areas potentially favorable for uranium.

INTRODUCTION

Purpose, Scope, and Methodology

The need and desirability of the "Geological, Energy and Minerals (GEM) Resources Assessment" in the "Wilderness Study Areas" (WSA) has been recognized and a series of such studies was recently undertaken by the U.S. Bureau of Land Management (BLM). The execution of the objective work is being performed by various contractors.

The selected Wilderness Study Areas, widely scattered within the "Sonoran Desert and Mexican Highlands" and grouped into "Region 5," have been studied and assessed by Geoexplorers International, Inc. The present report pertains to thirteen WSAs in southwestern Arizona which have been grouped together into the Kofa Geological, Energy and Mineral Resources Area (GRA).

The purpose of the present study is to assess the potential for locatable, leasable, and saleable resources within the GRA and, specifically, within each of the WSAs. This assessment has been carried out through literature study of the geology, structure, and economic geology of the GRA with consideration of the regional paleogeographic, plate tectonic, and metallogenic setting of the GRA within the southern Cordillera. Thus, the assessment is not only based on data from the GRA itself but also on metallogenic concepts within the regional paleogeographic and plate tectonic framework.

Geological, Energy and Mineral (GEM) Resources Area (GRA)

In this report, "resources" are defined as mineral and/or fossil fuel concentrations amenable to economic development under current or reasonably anticipated conditions. Resources include reserves and other mineral or fossil fuel concentrations that may eventually become reserves but are currently either economically or technically not recoverable. Resources are also defined as deposits inferred to exist but not yet discovered. Such resources cannot be considered as available until actually discovered.

Considering the BLM's requirements, the sub-area boundaries have been determined in accordance with the following criteria:

1. The size of the sub-area is approximately 690,000 acres (2,790 km^2) which, if shown on the map to the scale of 1:250,000 (also required by BLM), does not exceed a sheet of paper 8.5 by 11 inches,
2. The sub-area boundary does not cut across a Wilderness Study Area, and
3. The geologic environment and mineral occurrences are also taken into primary consideration.

The criteria for establishment of the Wilderness Study Areas are not the subject of this report. Also, their boundaries, code numbers, and names have been established by the Bureau of Land Management prior to this study.

The name "Kofa GRA," as defined below, has been suggested and used by the authors of this report as no name has yet been established by the Bureau of Land Management.

Location and Access

The Kofa GRA is located in the Yuma and Maricopa Counties in southwestern Arizona and in Imperial County in southeastern California. It lies within the Yuma Resource Area of the BLM-administered Yuma District and the Lower Gila Resource Area of the BLM-administered Phoenix District. It occupies the western and southwestern parts of the Phoenix 1:250,000 quadrangle and the eastern and southeastern parts of the Salton Sea 1:250,000 quadrangle approximately between latitudes 33° 00' and 33° 50' and longitudes 112° 50' and 114° 50'. The Kofa GRA has been subdivided into the Cibola, Brenda, Eagle Tail, and Saddle sub-areas as shown in Figure 1. The thirteen WSAs within the Kofa GRA are listed in Table 1 and their locations are shown in Figure 1.

Important access into the GRA is provided by the following: the Atchison, Topeka and Santa Fe Railroad runs across the northeastern corner of the Brenda sub-area; the Southern Pacific Railroad runs southwest-northeast across the Saddle sub-area; U.S. Highway 60-70 travels across the central part of the Brenda sub-area; U.S. Highway 80 traverses the eastern boundary of the Saddle sub-area; and Arizona Highway 95 runs through the central portion of the Cibola sub-area (Figure 1). Access to most of the valleys in the GRA is along light-duty and unimproved dirt roads, but access for vehicular traffic to the mountainous areas is very limited. No major towns are present within the GRA, but Phoenix lies approximately 30 miles east of the Saddle sub-area and Yuma about 20 miles south of the Cibola sub-area.

PHYSIOGRAPHY

The Kofa GRA lies within the Sonoran Desert section of the southern Basin and Range Province (Fenneman, 1931; Heindl, 1960), which here lies to the southwest of the Colorado Plateau. The area has a pronounced northwest-trending topographic grain which reflects Miocene Basin and Range normal faulting. The fault scarps have been eroded back considerable distances to form extensive pediments, and the range fronts are considerabley embayed (Tucker, 1980). This is because much of southwestern Arizona has been almost free of tectonic activity for the past several million years.

The GRA can be divided into three distinct physiographic terrains (Figure 1): mountainous-to-hilly terrain, lowlands, and floodplains of major rivers.

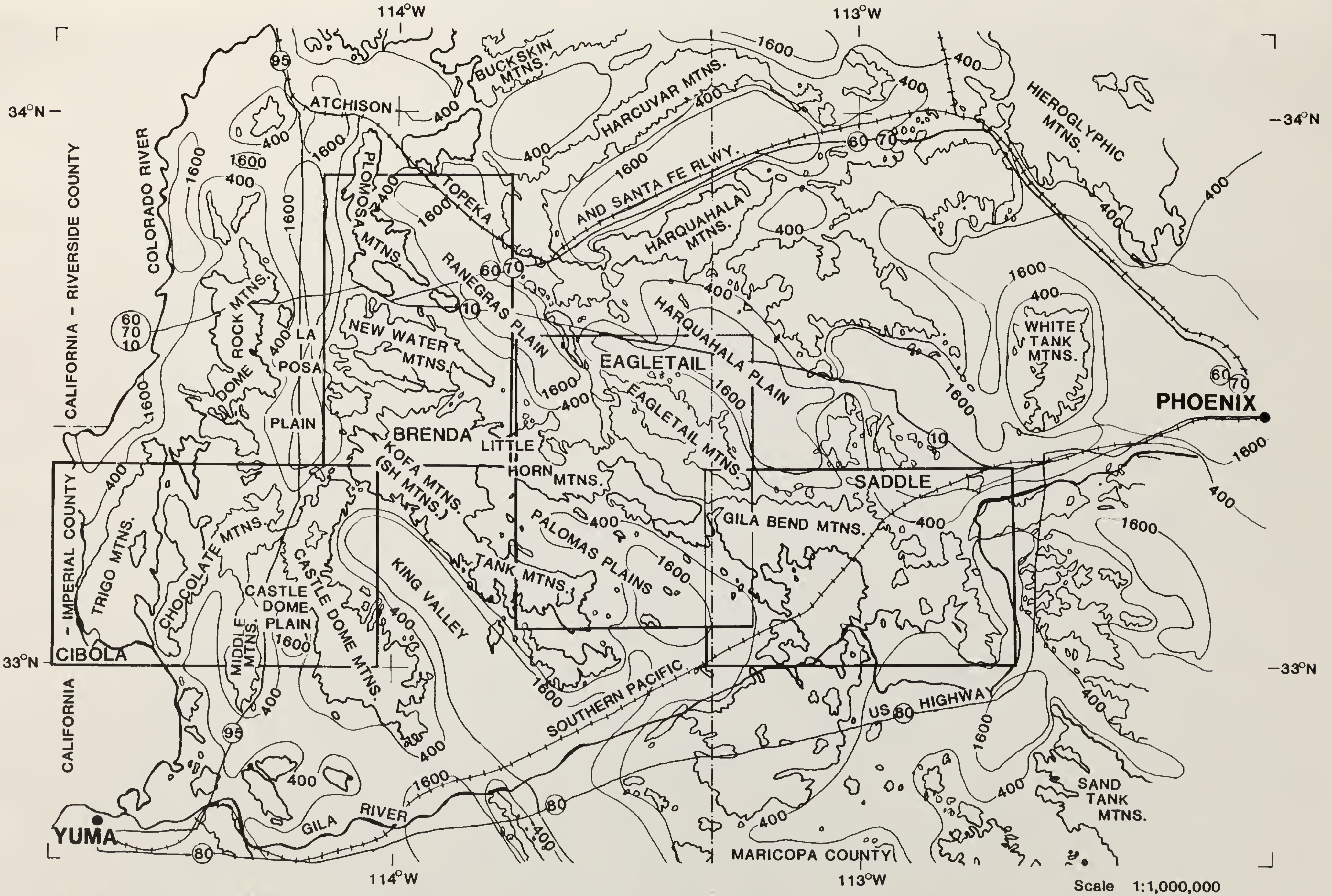


Figure 1. LOCATION OF THE CIBOLA, BRENDA, EAGLE TAIL AND SADDLE SUB-AREAS OF THE KOFA GRA. Surface physiography and depth to basement contours in feet, after Oppenheimer and Sumner (1981).

TABLE 1

WILDERNESS STUDY AREAS IN THE KOFA GRA

Sub-Area	WSA No.	WSA Name	Acres	km^2
Cibola	050-023B	Trigo Mountains	36,870	49.2
	050-023A	South Trigo Mountains	4,500	18.2
	050-034	Kofa Unit 4, Southern Addition	11,220	45.4
	050-033	Kofa Unit 4, Northern Addition	1,900	7.7
	050-031	Kofa Unit 3, Southern Addition	3,400	13.8
Brenda	020-125	New Water Mountains	58,600	237.1
Eagle Tail	020-126A	Little Horn Mountains West	13,800	55.8
	020-127	Little Horn Mountains East	91,930	371.9
	020-128	Eagle Tail Mountains	120,925	489.2
	020-129	Clanton Well	36,600	148.1
Saddle	020-136	Face Mountain	27,575	111.6
	020-138	Signal Mountain	20,920	84.7
	020-142/144	Woolsey Peak	73,930	299.2
Total			**502,170**	**2,031.9**

The mountainous-to-hilly terrain constitutes tectonic uplifts capped by mid-Tertiary volcanics and cored by Precambrian to Mesozoic basement. The Trigo and Chocolate Mountains in the Cibola sub-area have a north-south geologic, tectonic, and physiographic grain. The Castle Dome, Plomosa, New Water, Little Horn, Eagle Tail, and Gila Bend Mountains in the Brenda, Eagle Tail, and Saddle sub-areas have a pronounced northwest-trending geologic, tectonic, and physiographic fabric reflecting the dominant trend of Basin and Range faulting (Davis, 1981).

The lowland terrain constitutes tectonic, generally fault-bound depressions in which valley-fill sediments have been deposited and which have been widened through formation of pediment surfaces. In the western part of the GRA, the La Posa and Castle Dome Plains are aligned north-south, although embayments into the nearby ranges appear to have a northwesterly trend. The remaining lowlands, the Ranegras, Palomas, and Harquahala Plains, are aligned northwest-southeast parallel to the dominant trend of Basin and Range normal faulting.

Extensive floodplains are present along the Colorado River in the northwestern part of the Cibola sub-area and along the Gila River in the Saddle sub-area. These are the richest agricultural areas in the GRA.

GEOLOGY

Southwestern Arizona is an area of highly complex geology. Rocks range in age from Precambrian to Recent; and the region has been affected by Precambrian, mid-Mesozoic, Laramide and mid-Tertiary orogenies and by Basin and Range faulting. Important advances in the understanding of this complex terrain have been made since the publication of the Geologic Map of Arizona (Wilson et al., 1969) and have been summarized by Reynolds (1980). These advances have largely been the result of a greatly increased number of radiometric dates (Shafiqullah et al., 1980), regional analysis of deformation (Rehrig and Heidrick, 1967; Davis, 1981), recognition of metamorphic core complexes (Davis and Coney, 1979; Coney, 1980; Davis et al., 1980; Rehrig and Reynolds, 1980), recognition of the relationship between subduction magmatism and metallogenesis in the southern Cordillera (Coney and Reynolds, 1977; Damon et al., 1981), and an increased level of mapping of Cenozoic basins as a result of intense uranium exploration during the late 1970s (Eberly and Stanley, 1978; Scarborough and Wilt, 1979).

The lithology and stratigraphy, structural geology and tectonics, paleontology, and geologic history of the Kofa GRA are discussed in this section in order to facilitate the assessment of mineral potential within the GRA and, specifically, within the enclosed WSAs. The regional geologic setting and detailed geology of the Kofa GRA are shown in Figures 2 and 3 through 7, respectively.

Lithostratigraphy - Rock Units

In southwestern Arizona, older Precambrian crystalline basement is overlain by Paleozoic shallow marine sediments, Mesozoic volcanics and continental clastic sediments, mid-Tertiary volcanics and clastic continental sediments, and late Tertiary volcanics and valley-fill sediments. Intrusive activity and metamorphism took place during the Precambrian, mid-Mesozoic, Laramide and mid-Tertiary. Metamorphic core complexes were probably emplaced during the latter event.

Older Precambrian Rocks

Older Precambrian rocks in Arizona crop out most extensively in the northwest-trending Central Mountain region to the northeast of the Kofa

Figure 2: **Paleotectonic and paleogeographic maps of Arizona showing location of the Kofa GRA.**

A. Location of Precambrian terrains and the Holbrook, Bright Angle-Mesa Butte and Colorado lineaments, after Warner (1978) and Titley (1982).

B. Location of mid-Mesozoic magmatic arc, the Mojave-Sonora megashear and mid- to late Mesozoic red beds, after Dickinson (1981). The red beds postdate the magmatic arc and probably extend farther to the southwest than shown.

C. Location and age trends of major porphyry copper deposits. Note that these are aligned parallel to northwest-trending Paleozoic-Mesozoic discontinuities (Lowell, 1974; numbers 1-6 correspond to discontinuities named in Heidrick and Titley, 1982), along northwest-trending Laramide magmatic arcs (v pattern), and along northeasterly Precambrian trends (Heidrick and Titley, 1982). Curved black lines show location of arc at different times, as given.

D. Location of Precambrian alkali and alkali-calcic intrusions and mid-Tertiary metamorphic core complexes, mid-Tertiary alkali-calcic volcanics and sedimentary domains (Scarborough and Wilt, 1979).

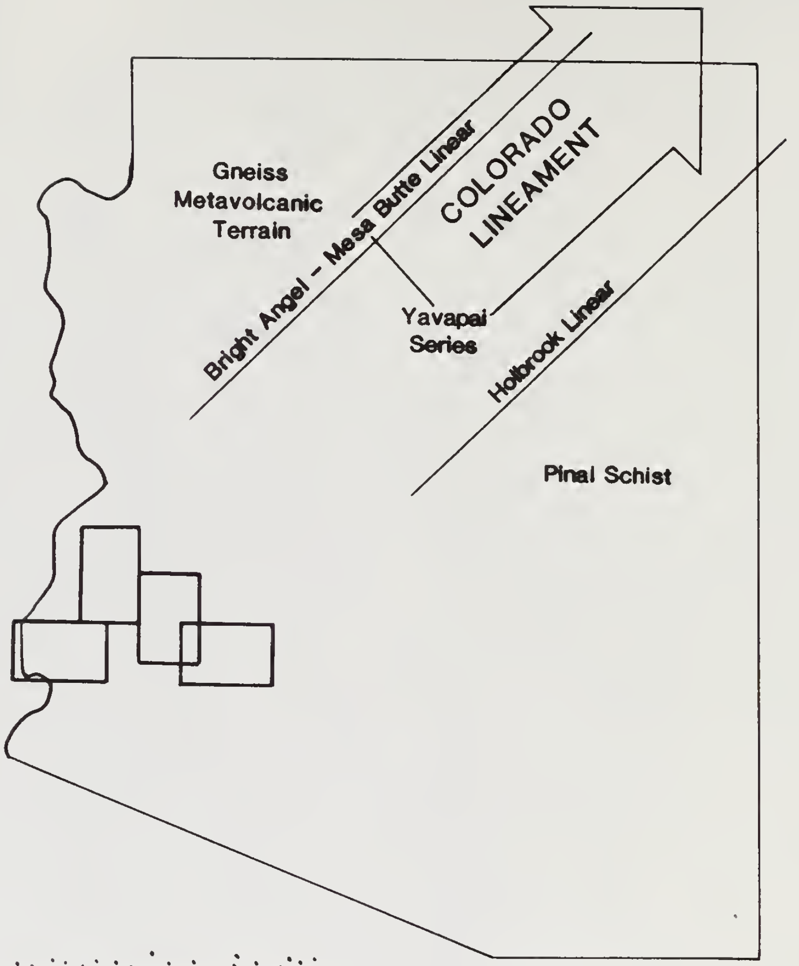


Figure 2A.

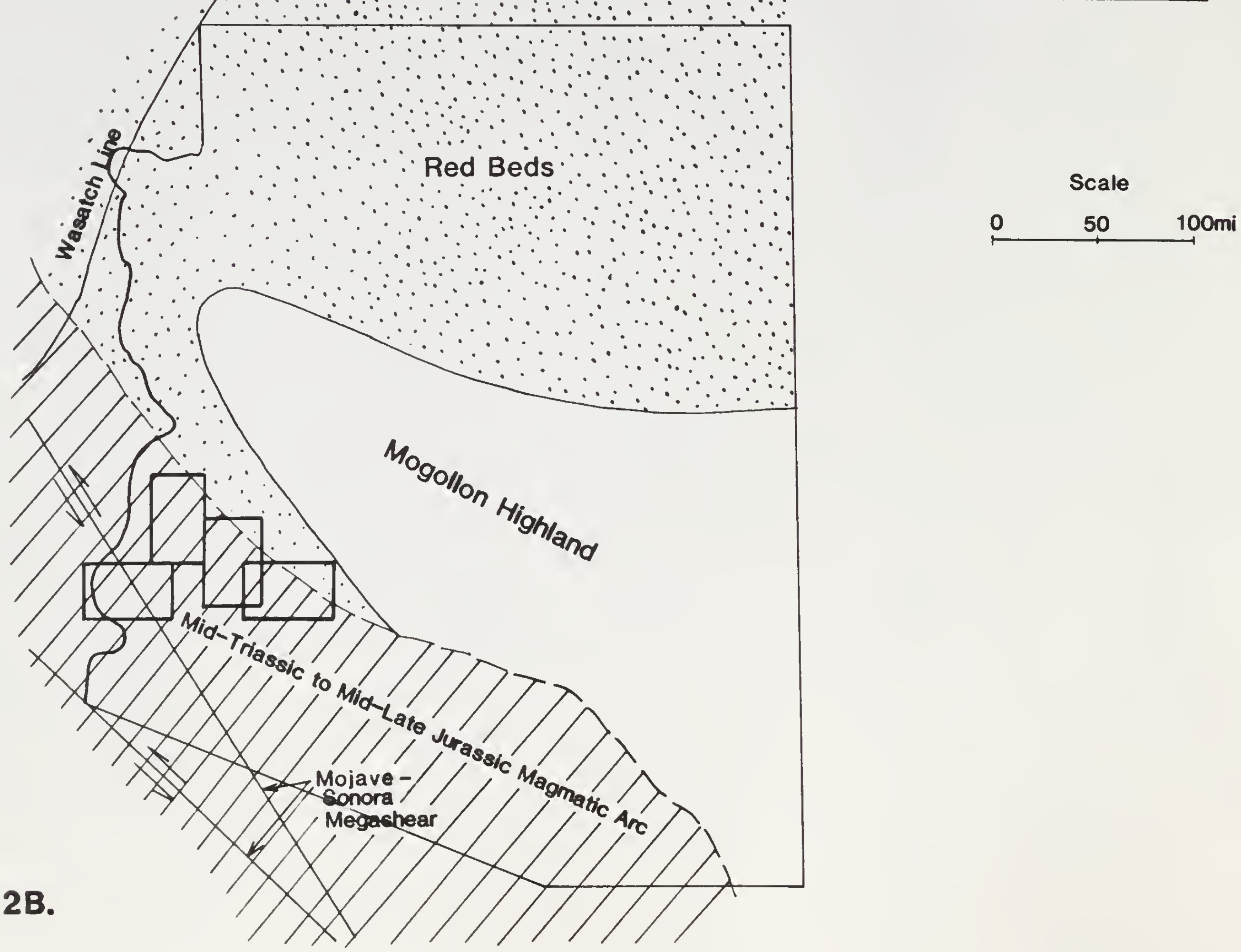


Figure 2B.

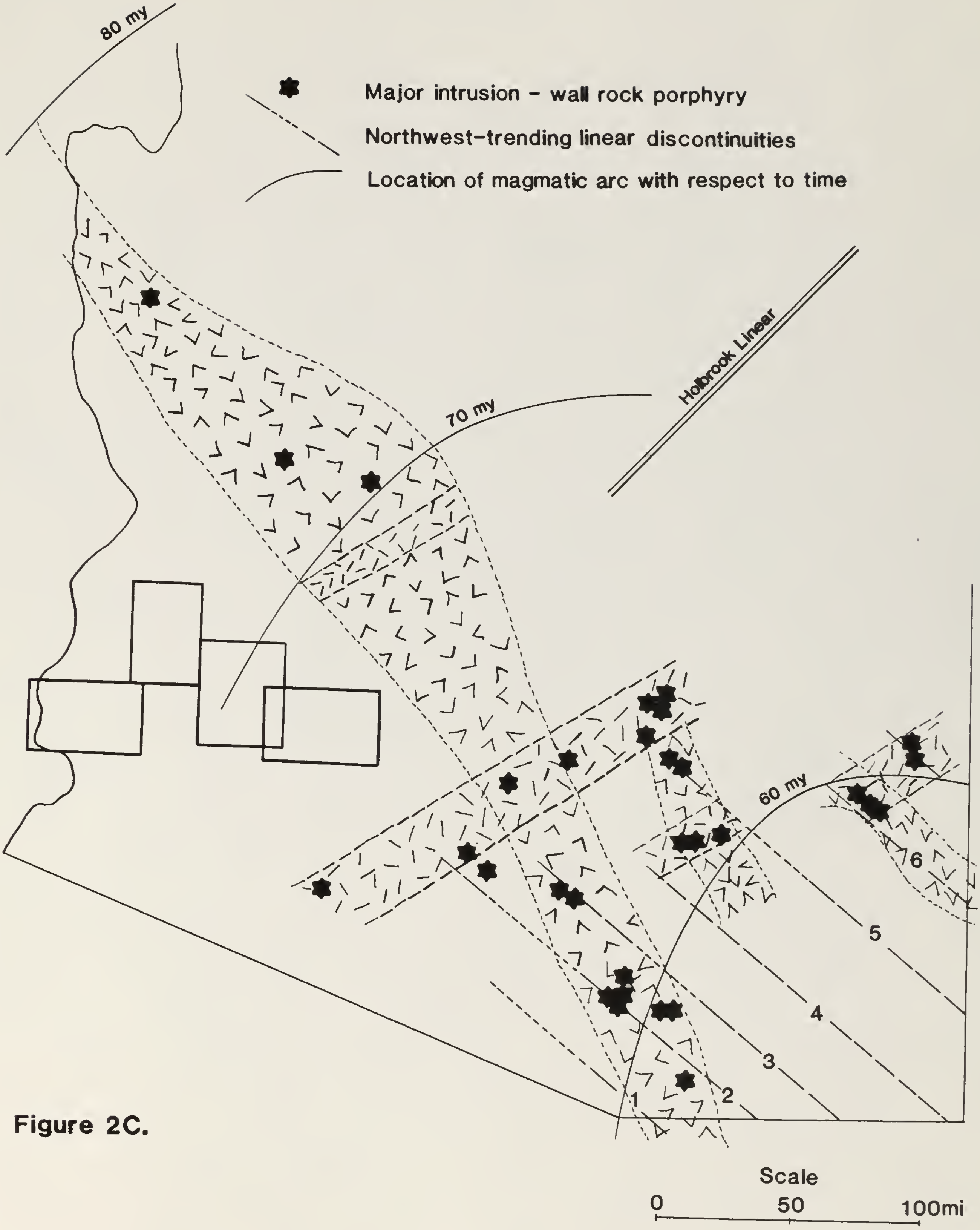

Major intrusion - wall rock porphyry
Northwest-trending linear discontinuities
Location of magmatic arc with respect to time
80 my
70 my
60 my
Holbrook Linear
1
2
3
4
5
6
Scale
0
50
100mi

Figure 2C.

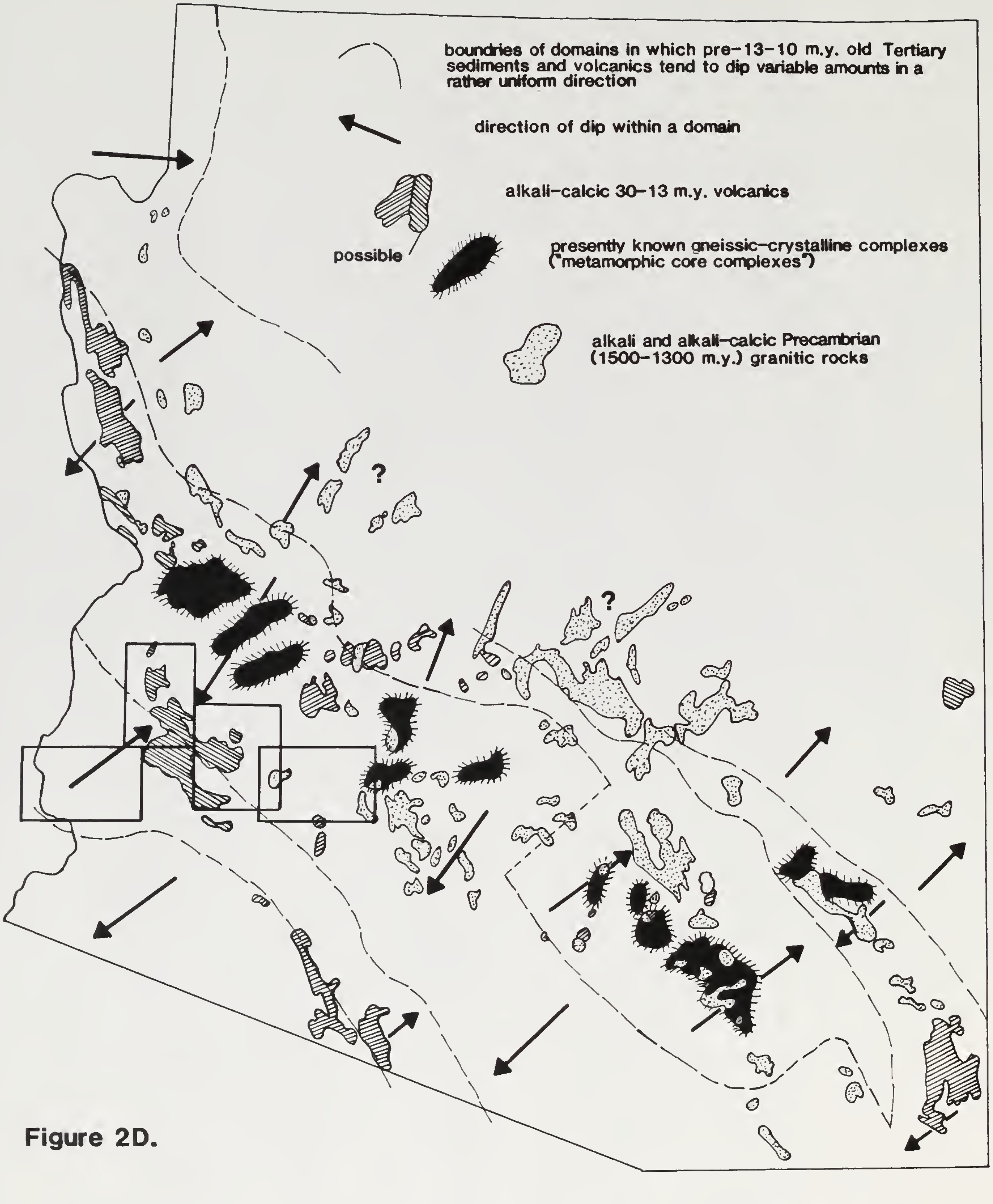
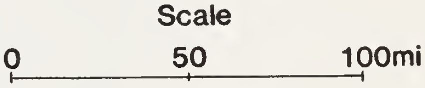

boundries of domains in which pre-13-10 m.y. old Tertiary sediments and volcanics tend to dip variable amounts in a rather uniform direction
direction of dip within a domain
alkali-calcic 30-13 m.y. volcanics
possible
presently known gneissic-crystalline complexes ("metamorphic core complexes")
alkali and alkali-calcic Precambrian (1500-1300 m.y.) granitic rocks
?
?

Figure 2D.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100mi

GRA. Here they have been divided into three distinct northeast-trending belts (Figure 2; Titley, 1982) which, according to Anderson (1976), accreted onto the North American craton from the southeast.

The most northwesterly belt consists of gneisses which are in part metavolcanic, have been metamorphosed to the amphibolite facies (Stensrud and More, 1980), and were deposited about 1.8 b.y.B.P. (Titley, 1982). The central belt consists of the Yavapai Series which was deposited 1.82 - 1.775 b.y.B.P. (Anderson and Silver, 1976). It is a greenstone belt which is approximately 40,000 feet thick, is dominated by volcanic and volcanoclastic rocks of basaltic to rhyolitic composition (Anderson and Silver, 1976; Titley, 1982), and has been metamorphosed to the greenschist facies. Massive sulfide copper-zinc deposits are associated with submarine rhyolitic volcanism, especially in the Prescott-Jerome area (Donnelly and Hahn, 1981). The southeastern belt consists of the Pinal Schists which were deposited 1.7 - 1.68 b.y. B.P. (Silver, 1978) and consist of quartz muscovite schist, arkose and quartzite (Titley, 1982).

The older Precambrian rocks were metamorphosed and intruded by granites during the Arizonan revolution 1.76 - 1.63 b.y.B.P. (Damon, 1968) and were intruded by granites during the Mazatzal revolution 1.5 - 1.4 b.y.B.P. (Damon, 1968; Silver et al., 1977).

In the Kofa GRA, older Precambrian rocks occur in the Gila Bend Mountains in the northwestern and eastern sections of the Saddle sub-area. Very little is known about these rocks. They consist of gneiss, minor schist and granitic intrusives (Figures 3 through 7).

According to Shafiqullah et al. (1980), the metamorphic rocks in this area are generally dark amphibolite gneisses and augen gneisses, in contrast to the lower grade greenschist facies rocks to the northeast. The southwestern extension of the boundary between the Yavapai Series and the Pinal

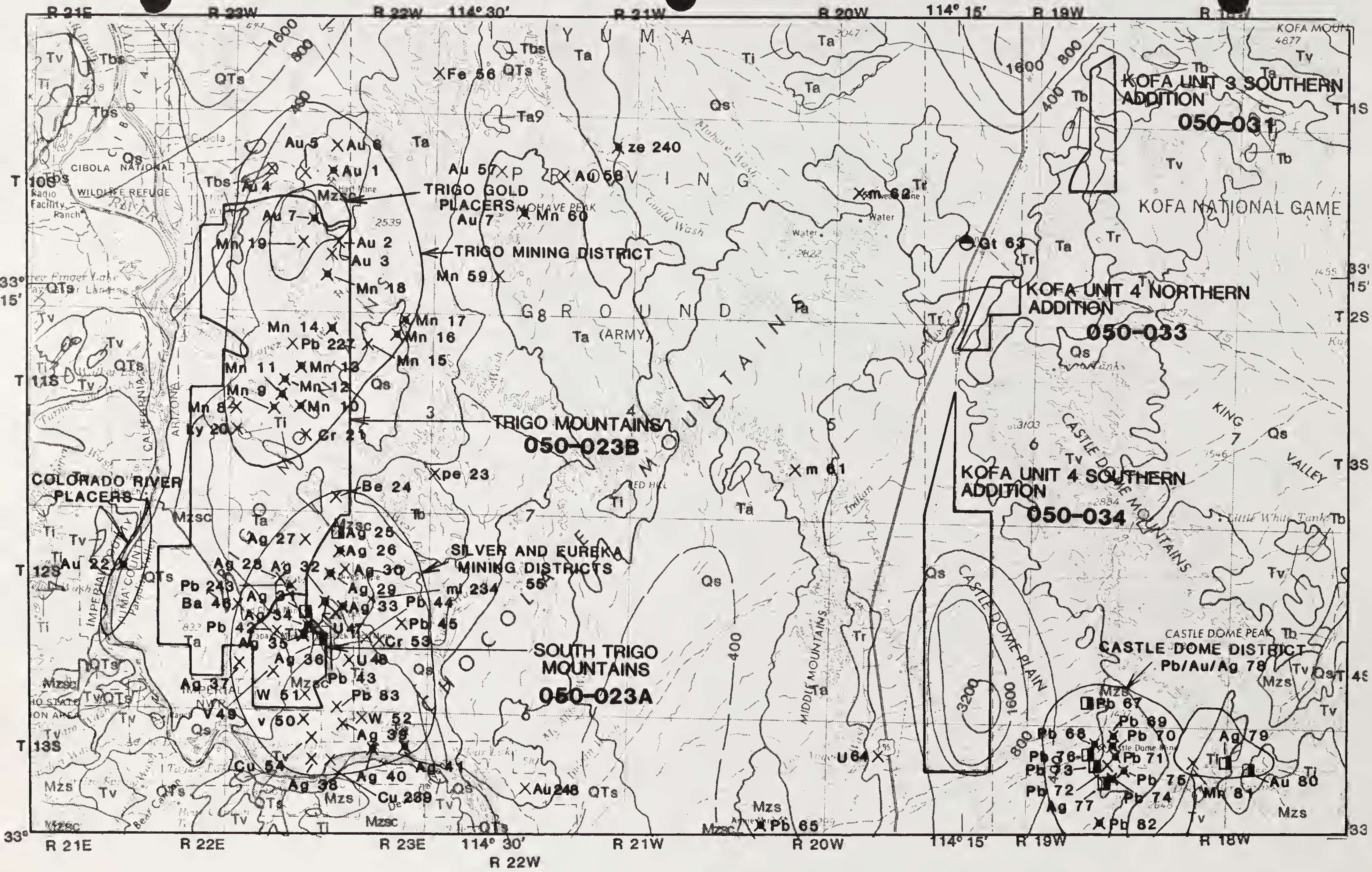


FIG.3 GEOLOGIC, ENERGY AND MINERAL RESOURCES MAP OF THE CIBOLA SUB-AREA, ARIZONA

Scale
1 : 250,000
LEGEND: see enclosed

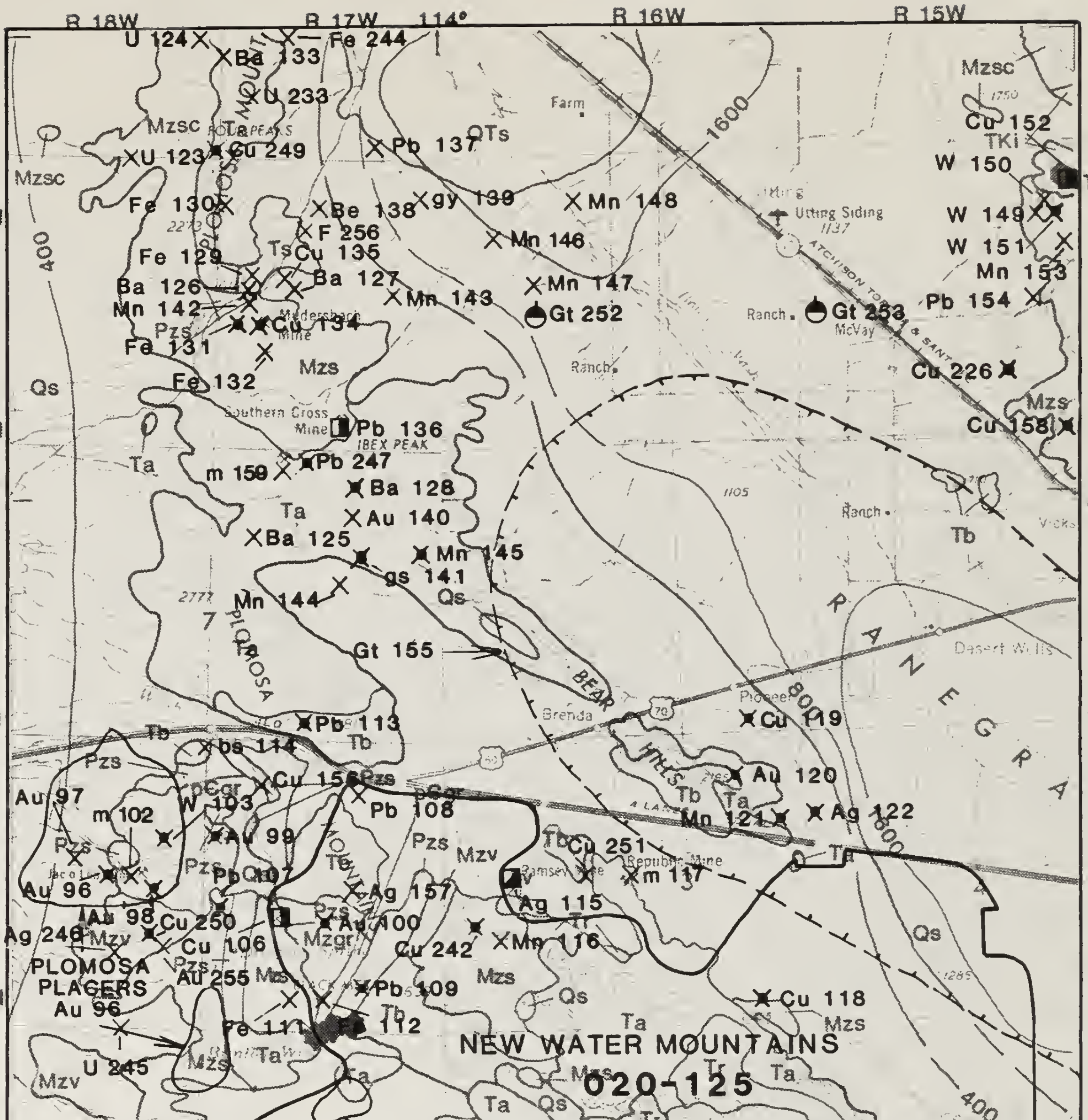


FIG. 4 GEOLOGIC, ENERGY AND MINERAL RESOURCES MAP OF THE BRENDA SUB-AREA, ARIZONA

Scale
1 : 250,000
LEGEND: see enclosed

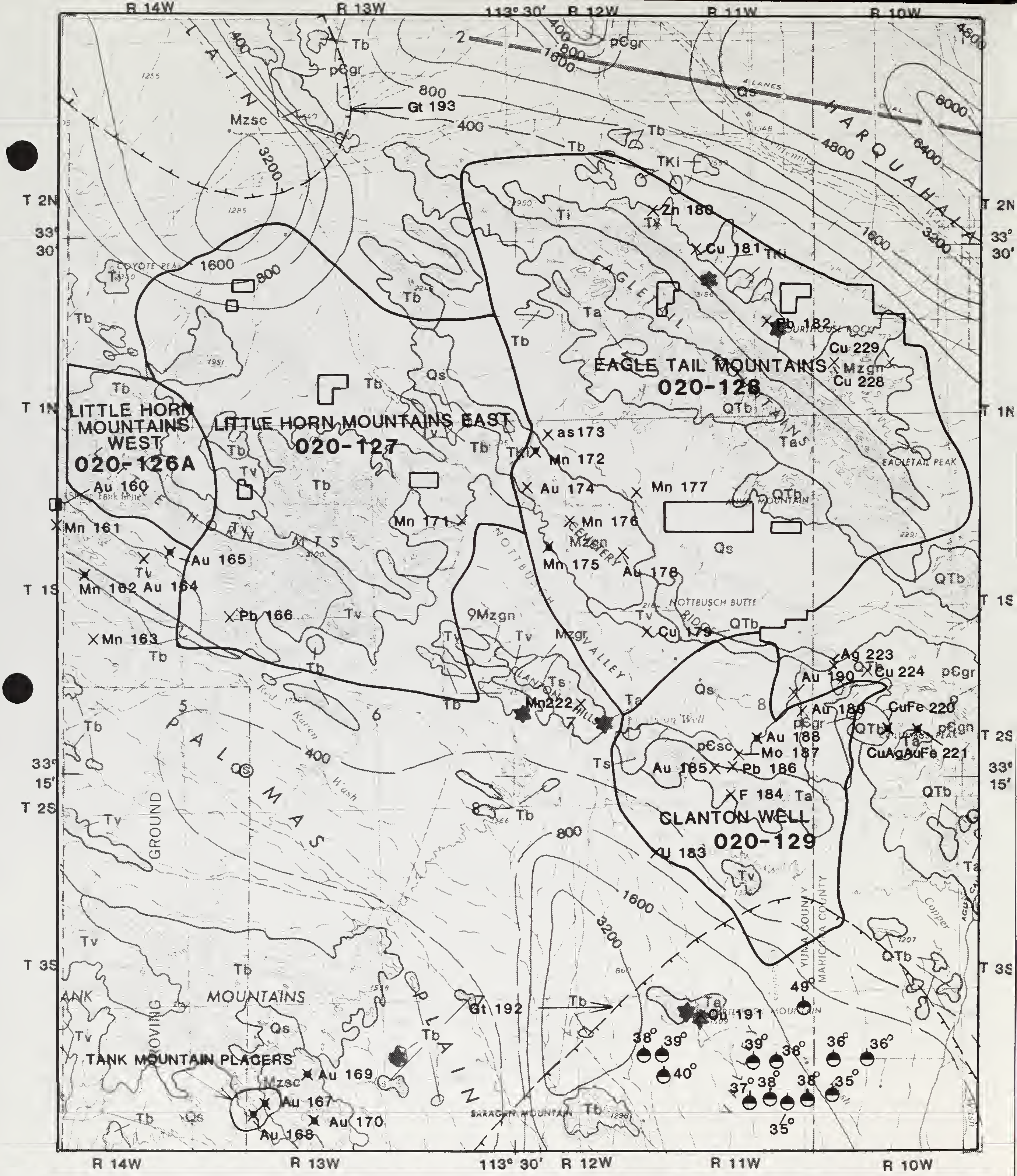


FIG. 5 GEOLOGIC, ENERGY AND MINERAL RESOURCES MAP OF THE EAGLE TAIL SUB-AREA, ARIZONA

Scale
1 : 250,000
LEGEND: see enclosed

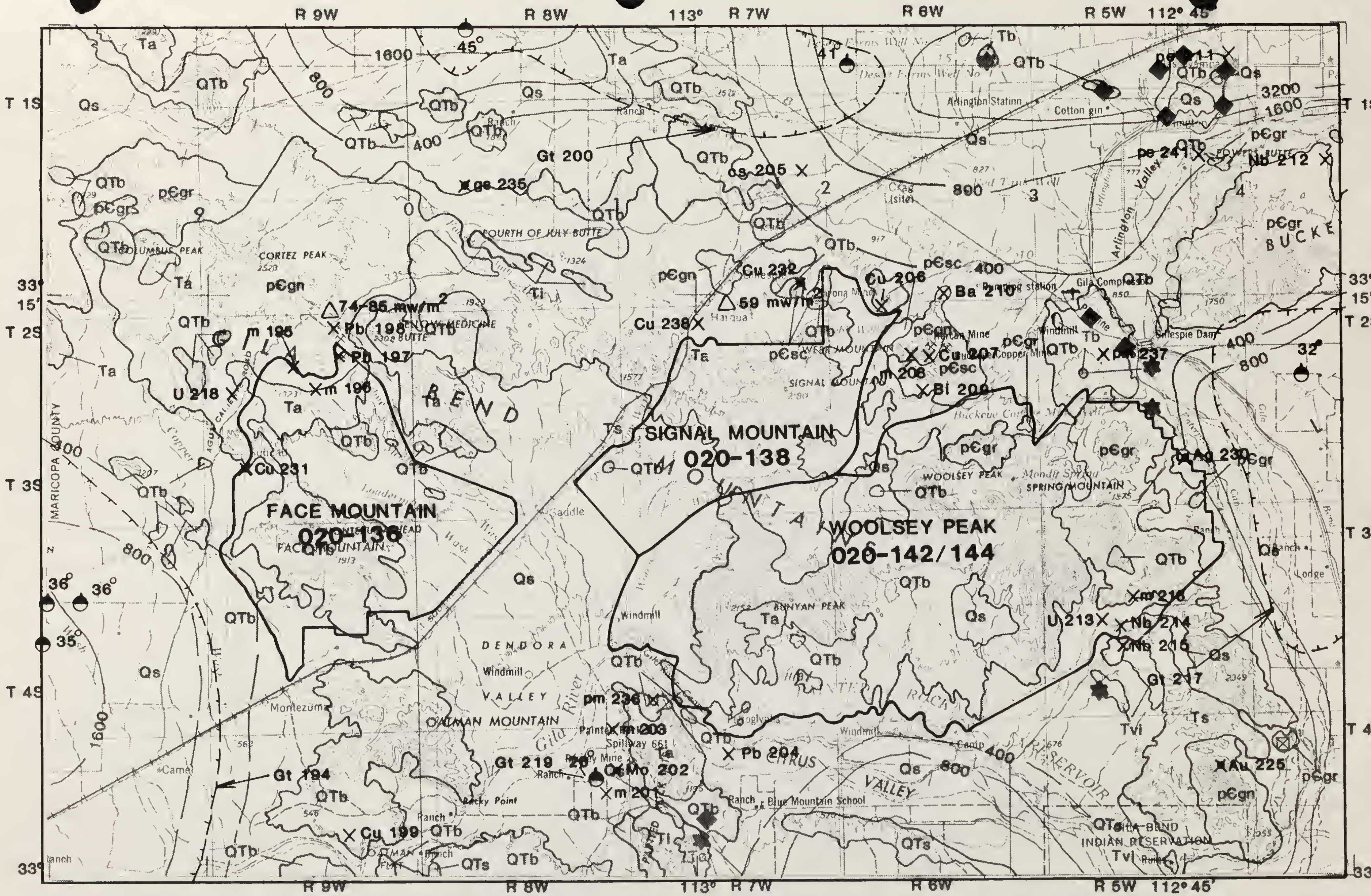


FIG. 6 GEOLOGIC, ENERGY AND MINERAL RESOURCES MAP OF THE SADDLE SUB-AREA, ARIZONA

Scale
1 : 250.000
LEGEND: see enclosed

Figure 7. LEGEND
FOR
GEOLOGIC, ENERGY AND MINERAL RESOURCES MAPS

Scale of all maps is 1:250,000 or as otherwise indicated.

GEOLOGY AND LITHOSTRATIGRAPHY

After Wilson et al.(1969) modified after Eberley and Stanley (1978) ,
Jennings (1967), Metzger (1968), Oppenheimer and Sumner (1981), Reynolds (1980),
Scarborough (1979), Scarborough and Wilt (1979),
Shafiqullah et al.(1980), Titley (1981, 1982).

QUATERNARY	Qs	Unconsolidated alluvial fan and floodplain deposits.
QUATERNARY TO LATE TERTIARY	QTs	Poorly consolidated fanglomerates and fluvial sands and gravels.
	QTb	Basaltic flows and flow breccias.
	Tbs	Bouse Formation, marine limestone and siltstone.
MID TERTIARY	Ts	Conglomerates, sandstones, mudstones and minor limestones.
	Tr	Rhyolitic flows, tuffs, and tuffaceous sediments. Locally tuffaceous.
	Ta	Andesitic flows, breccias and tuffs.
	Tb	Basaltic flows and breccias.
	Tvi	Intermediate flows and tuffs.
	Tv	Undifferentiated volcanics.
	Ti	Small stocks, plugs, dikes, sills of rhyolitic to basaltic composition.
TERTIARY TO CRETACEOUS	TKi	Granitic and tonalitic, generally two-mica, intrusives.

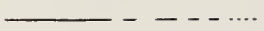
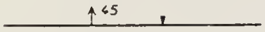
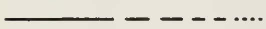
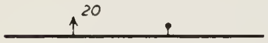
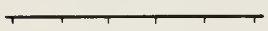
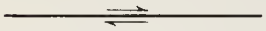
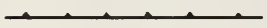
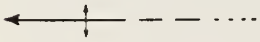
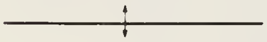
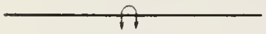
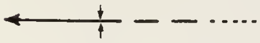
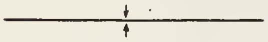
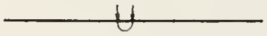
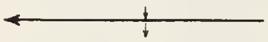
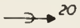
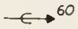
MESOZOIC	Mzs	Conglomerates, sandstone, mudstone and limestones, locally red near base.
	Mzv	Rhyolitic to dacitic flows and tuffs.
	Mzgr	Granitic intrusives.
	Mzsc	Schist.
	Mzgn	Gneiss.
PALEOZOIC	Pzs	Quartzite, sandstone, shale, dolomite and limestone, locally metamorphosed.
PRECAMBRIAN	p€gr	Granitic intrusives.
	p€sc	Schist.
	p€gn	Gneiss.

400	Contours in feet show depth to basement, after Oppenheimer and Sumner (1981).

Radiometric dates:

☒	Precambrian
✶	40–14 million years, before present
◆	14–0 million years, before present

SPECIAL SYMBOLS
OF STRUCTURAL FEATURES
After U.S. Geological Survey

	Contact – Dashed where approximately located; short dashed where inferred; dotted where concealed
	Contact – Showing dip; well exposed at triangle
	Fault – Dashed where approximately located; short dashed where inferred; dotted where concealed
	Fault, showing dip – Ball and bar on downthrown side
	Normal fault – Hachured on downthrown side
	Fault – Showing relative horizontal movement
	Thrust fault – Sawteeth on upper plate
	Anticline – Showing direction of plunge; dashed where approximately located; dotted where concealed
	Asymmetric anticline – Short arrow indicates steeper limb
	Overturned anticline – Showing direction of dip of limbs
	Syncline – Showing direction of plunge; dashed where approximately located; dotted where concealed
	Asymmetric syncline – Short arrow indicates steeper limb
	Overturned syncline – Showing direction of dip of limbs
	Monocline – Showing direction of plunge of axis
	Minor anticline – Showing plunge of axis
	Minor syncline – Showing plunge of axis

Strike and dip of beds – Ball indicates top of beds known from sedimentary structures

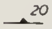
Inclined

Horizontal

Vertical

Overturned

Strike and dip of foliation

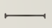

Inclined

Vertical

Horizontal

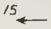
Strike and dip of cleavage

Inclined


Vertical

Horizontal

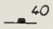
Bearing and plunge of lineation


Inclined

Vertical

Horizontal

Strike and dip of joints


Inclined

Vertical

Horizontal

Note: planar symbols (strike and dip of beds, foliation or schistosity, and cleavage) may be combined with linear symbols to record data observed at same locality by superimposed symbols at point of observation. Coexisting planar symbols are shown intersecting at point of observation.

SPECIAL SYMBOLS

FOR ENERGY AND MINERAL RESOURCES

KNOWN DEPOSITS AND OCCURRENCES

◌-O Oil field
◌-G Gas field
◌-Os Oil shale

◌-C Coal deposit
⬡-C Coal occurrence

■-Mineral orebody - as specified with symbol
◨-Mineral deposit - as specified with symbol
□-Mineral occurrence - as specified with symbol
▭-Mineral district (Fig.= inserted map)

EXPLORATION AND/OR MINING ACTIVITY

MINERALS AND COAL

✕ Mineral deposit, mine or prospect with recorded prod.
✕ Prospect or mine with no recorded production
≻— Accessible adit, or tunnel
≻+— Inaccessible adit, or tunnel

◪ Vertical shaft
◪ Inclined shaft
⚒ Active open pit, or quarry
⚒ Inactive open pit, or quarry

✕ Active gravel or clay (cl) pit
✕ Inactive gravel or clay (cl) pit
⊕ Exploration hole with data available
⊗ Exploration hole without data
▭ Mining district (Fig.= inserted map)

PETROLEUM

● Oil well
● Oil and gas well
☼ Gas well

○ Show of gas
◑ Show of oil
◑ Show of oil and gas
○ Shut-in well

⊙ CO_2- or He-helium- rich well
⌖ Dry well - abandoned

GROUND WATER

○ Water well of special importance
○ Water well of high yield
○ Flowing water well

⊖ Brine
◑ Mineral water

⊖ Thermal water
⊗ Radioactive water
△ Thermal point

ENERGY RESOURCES

O	Oil	C	Coal	U	Uranium
G	Gas	Cb	Lignite (brown coal)	Th	Thorium
Os	Oil shale	Cp	Peat	Gt	Geothermal
Ot	Tar sands				

MINERAL RESOURCES

METALS

Al Aluminum
Sb Antimony
As Arsenic
Be Beryllium
Bi Bismuth
Cd Cadmium
Cr Chromium
Cs Cesium
Co Cobalt

Cu Copper
Ga Gallium
Ge Germanium
Au Gold
Fe Iron
Pb Lead
Li Lithium
Mn Manganese
Hg Mercury

Mo Molybdenum
Ni Nickel
Nb Niobium or Columbium
Pt Platinum group
RE Rare earth
Re Rhenium
Sc Scandium
Ag Silver
Te Tellurium

Tl Thallium
Sn Tin
Ti Titanium
W Tungsten
V Vanadium
Zn Zinc
Zr Zirconium and
Hf Hafnium

NONMETALS - INDUSTRIAL MINERALS

ab Abrasives
al Alum
as Asbestos
Ba Barite
be Bentonite
ca Calcite
cl Clay

Construction materials:

cs Crushed stone
la Lightweight aggregates, includ.:
    pm Pumice and volcanic cinders
    pe Perlite
    ec Expanded clay, shale, slate
    vm Vermiculite
sg Sand and gravel
cr Cement raw materials
bs Building stones
li Lime

di Diatomite

Nonmarine and marine evaporites and brines

pt Potash
na Salt - mainly halite
gy Gypsum and anhydrite
nc Sodium carbonate or sulfate
bn Boron minerals
ni Nitrates
Sr Strontium
Br Bromine
cc Calcium chloride
mg Magnesium compounds

fs Feldspar
F Fluorite (fluorspar)
gs Gem stones
ge Graphite
He Helium
ki Kaolin
ky Kyanite and related minerals
ls Limestone
lm Lithium minerals

mg Magnesian refractories
mi Mica
ph Phosphate
pi Pigment and fillers
qz Quartz crystals
si Silica sand
S Sulfur
tc Talc
ze Zeolites
hm Humate

SPECIAL GEOLOGICAL FEATURES

POINT OF SPECIAL GEOLOGIC INTEREST

m	Mineral occurrence
f	Fossil locality
v	Volcanic phenomenon
t	Stratigraphic sequence
s	Structural, bedding, foliation, etc.,
b	Brecciation, shear zone, etc.,
y	High yield spring
p	Spring with mineral water
u	Radioactive spring
g	Thermal spring
a	Extensive rock alteration
r	Lithologic type locality

FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE FOR MINERAL RESOURCES

FAVORABILITY:

1A - Undefined
1 - Not favorable - combine with either B, C, or D
2 - Low
3 - Moderate
4 - High
(2, 3, 4) combine with either A, B, C, or D

LEVEL OF CONFIDENCE:

A - Insufficient data
B - Indirect evidence
C - Direct evidence
D - Abundant direct and indirect evidence

Schist and the approximately coincident Holbrook Line (see Figure 2) of magnetic anomalies projects through the central Gila Bend Mountains. It is not known whether this geologic boundary can be extended this far to the southwest; but if so, then the Precambrian gneiss at the west end of the Saddle sub-area could be a high-grade correlative of the Yavapai Series, and the schist and gneiss on the eastern side of the Saddle sub-area could be a correlative of the Pinal Schist (Figures 6 and 7).

The granitic rocks, according to Wilson et al. (1969), may range in composition between granite and quartz diorite. According to P. Anderson (pers. comm. to Scarborough and Wilt, 1979), they are alkali and alkali-calcic and range in age from 1.5 to 1.3 b.y.B.P.

Paleozoic

Paleozoic sedimentary rocks crop out in the northern and central Plomosa Mountains in the Brenda sub-area. Paleozoic rocks in this area have been described by Miller (1970) and recently by Reynolds (1980). They consist mainly of quartzite, dolomite and limestone and include the Bolsa Quartzite, Abrigo Formation, Martin Formation, Escabrosa Limestone, Supai Formation, Coconino Sandstone, and the Kaibab Limestone, or their stratigraphic equivalents. The sediments were laid down in a shelf environment on a stable platform to the east of the Cordilleran geosyncline (see Figure 2) from which they are separated by the Wasatch Line (Burchfiel, 1979).

The Bolsa Quartzite is Cambrian and consists of brown to maroon quartzite. It is 330 feet thick and unconformably overlies Precambrian crystalline basement. It is conformably overlain by the Cambrian Abrigo Formation, 160 feet of sandy shale interbedded with calcareous fine-grained quartzite.

The overlying Martin Formation is Devonian and disconformably overlies the Cambrian strata. Apparently, the region was a structural high during the Ordovician and Silurian, and no sediments of that age were deposited in southwest Arizona. The Martin Formation consists of dolomite limestone, dolomite and sandy dolomite and is 330 feet thick. The remaining Paleozoic formations form a conformable sequence. The Mississippian Escabrosa Limestone is a tan-weathering dolomite and cherty limestone and is about 400 feet thick. The Supai Formation is Pennsylvanian to Permian and consists of white, pink, maroon, or light brown quartzite interbedded with limestone and a reddish mudstone. It is between 550 and 1,200 feet thick. The overlying Coconino Sandstone and Kaibab Limestone are Permian. The Coconino Sandstone consists of gray vitriteous quartzite and is between 660 and 1,100 feet thick. Finally, the Kaibab Limestone is 660 to 1,100 feet thick and consists of chert-bearing limestone.

The Paleozoic sedimentary rocks vary from virtually unmetamorphosed sediments to highly metamorphosed schistose rocks and wollastonite-bearing carbonate rocks.

Mesozoic

Mesozoic rocks have only recently been studied in detail and their stratigraphy and structure are imperfectly known. They can be broadly divided into mid-Mesozoic volcanic and intrusive rocks and late Mesozoic clastic sediments (Reynolds, 1980).

The mid-Mesozoic volcanic and plutonic rocks crop out in the Plomosa Mountains in the west-central and southern parts of the Brenda sub-area where they have been described by Miller (1970) and Reynolds (1980). The volcanic rocks are dacitic, quartz latitic and rhyolitic in composition and include flows, ash-flow tuffs, and agglomerates that are locally interbedded with volcanic conglomerate, sandstone and red mudstone. They are up to three miles thick. The plutonic rocks are granitic, intrude Paleozoic sediments, and are characterized by abundant K-feldspar phenocrysts. They have been dated as mid-Jurassic and are possibly coeval with the volcanic rocks. The igneous rocks lie on a mid-Jurassic magmatic arc which extends across southwestern Arizona (see Figure 2) and includes the intrusive rocks with which the well-known porphyry copper deposit at Bisbee is associated.

Following the mid-Jurassic, the dip of the Benioff zone steepened and the magmatic arc moved west (Coney and Reynolds, 1977); and in southwestern Arizona, late Mesozoic clastic beds were deposited. These crop out extensively in the Kofa GRA, particularly in the Trigo and Castle Dome Mountains in the Cibola sub-area, the Plomosa Mountains and Livingston Hills in the Brenda sub-area, and in the Little Horn and Tank Mountains in the Eagle Tail sub-area. They are described in general by Reynolds (1980) and in some detail in the Plomosa Mountains by Robinson (1980) and Harding (1980).

The basal sequence of the sediments is described by Robinson (1980) and consists of red beds that are about 3,000 feet thick. They consist of conglomerate (5 percent), sandstone (25 percent), siltstone (15 percent), mudstone (40 percent), and limestone with gypsum (15 percent), all a characteristic red color and deposited in a cyclothemic pattern. The red beds are interpreted to have been deposited by a meandering stream entering into a playa environment where periodic evaporation precipitated the limestone and gypsum. The red beds rest disconformably on the mid-Mesozoic volcanics and are probably late Jurassic to early Cretaceous. They are of Paleozoic provenance from the Mogollon Highlands (Figure 2).

The red beds are conformably overlain by the Livingston Hills Formation which is described from the Plomosa Mountains and from the Livingston Hills by Harding (1980). In the Livingston Hills, the formation is at least

10,800 feet thick; whereas in the Plomosa Mountains, it is at least 5,700 feet thick. In neither area is the top exposed. In both areas, the lower third of the formation is dominated by conglomerate, the middle third by sandstone, and the upper third by siltstone. The formation contains quartzite and carbonate clasts, probably of Paleozoic provenance, and in the upper part, silicic, volcanic, and granitic clasts, probably of mid-Mesozoic magmatic arc provenance.

In some areas, the Mesozoic volcanic and clastic rocks have been metamorphosed to schists and gneisses. In the Granite Wash Mountains in the northeast corner of the Brenda sub-area, metamorphic structures are cut by a Laramide pluton (Rehrig and Reynolds, 1980). Thus, the metamorphism is pre-Laramide.

Laramide

The Laramide was a period of volcanism, intrusion, and intense tectonic activity in southern Arizona. It is of particular importance because a large number of porphyry copper deposits were formed at this time, especially in southeastern Arizona (Damon and Mauger, 1966; Shafiqullah et al., 1980; Titley, 1981; Heidrick and Titley, 1982; see Figure 2). The magmatic and tectonic activity was related to the southeastward sweep of the magmatic arc as the dip of the Benioff zone decreased (Coney and Reynolds, 1977; Clark et al., 1982).

In the Kofa GRA, Laramide intrusives occur in the Granite Wash Mountains in the northeast corner of the Brenda sub-area and on the northeast slope of the Eagle Tail Mountains in the Eagle Tail sub-area. They are also present to the northwest of the GRA in the Whipple Mountains in California and in the Gunnery Range to the south.

In the Granite Wash Mountains, the granitic rocks are locally foliated, contain xenoliths of gneiss, and are cut by garnet and muscovite-bearing pegmatites and aplites (Rehrig and Reynolds, 1980). In the Eagle Tail Mountains, the intrusives are diorites (Shafiqullah et al., 1980). In the Whipple Mountains, the Laramide granites are synkinematic with mylonitization associated with a metamorphic core complex (Davis et al., 1980). They include foliated biotite granodiorite, a two-mica adamellite, a garnet two-mica adamellite, and a two-mica tonalite. The rocks are calc alkaline and peraluminous. The Gunnery Range Batholith is, according to Shafiqullah et al. (1980), a two-mica granite. Most of these Laramide intrusives in southwestern Arizona thus appear to have at least some characteristics of S-type granites as described by Chappell and White (1974). In the Granite Wash Mountains, the granites intrude metamorphosed Mesozoic rocks; thus, they postdate an earlier Mesozoic period of folding and metamorphism. In the Whipple Mountains, they are coeval with the early stages of emplacement of metamorphic core complexes.

Metamorphic Core Complexes

More than a dozen metamorphic core complexes have been identified and described recently in southwestern Arizona. They occur along a northwest-trending zone that extends from southeastern to west-central Arizona and are part of a more extensive zone that runs from Sonora to Arizona through eastern Nevada, Idaho, eastern Washington, and southeastern British Columbia (Coney, 1980). Their general features have been summarized recently by Davis and Coney (1979) and Reynolds (1980) as follows. Metamorphic core complexes are characterized by metamorpic and mylonitic rocks whose gently dipping foliation defines broad domes which generally are elongated in an ENE-to-NE direction. The core of the domes consist of amphibolite facies gneisses, and granites that have undergone ductile deformation. Up section, a mylonitic fabric with an ENE-to-NE lineation is overprinted on both igneous and metamorphic rocks. This grades upward into a greenschist facies breccia over a short distance and records a sharp thermal and strain gradient. The breccia is overlain by a narrow decollement zone, or dislocation plane, above which allochthonous, deformed, but unmetamorphosed, upper plate rocks are present. These range in age from Precambrian to Miocene and have undergone listric normal faulting as recently as mid-Miocene. The core complexes typically record 30 to 20 m.y.B.P. K-Ar cooling ages. It is generally agreed that the complexes formed in an extensional environment (back-arc spreading?) during and after the fast regression of the magmatic arc 40 to 20 m.y.-B.P. (Coney and Reynolds, 1977) at a time of high heat flow. Davis and Coney (1979) regard the complexes as megaboudins formed from crystalline basement. Rehrig and Reynolds (1980) agree that the complexes formed by an extensional process but consider that the metamorphic core complex itself developed between, rather than within, separating blocks.

No metamorphic core complexes crop out within the GRA; but the Harcuvar metamorphic complex lies a short distance north and northeast of the Brenda sub-area, and part of it could lie buried beneath valley-fill sediments in the Ranegras Plain.

Mid-Tertiary

Mid-Tertiary rocks are here defined to include all sedimentary and igneous rocks deposited after the Laramide orogeny and the post-Laramide period of peneplanation and before Basin-and-Range-type faulting became dominant. These pre-Basin-and-Range rocks have been divided into three units by Eberly and Stanley (1978) and Scarborough and Wilt (1979).

The lowest unit consists of indurated, red to brown arkosic fluvial sandstone, fanglomerates of gneissic and grantic provenance up to 300 feet thick, and minor lacustrine sediments with some algal limestone. Andesitic to rhyolitic volcanics increase in abundance towards the upper part of this unit.

The middle unit is characterized by voluminous intermediate to felsic volcanism that is associated with the mid-Tertiary orogeny. The volcanics consist of flows, ash flow tuffs, tuff breccias and ash of latitic, quartz latitic, rhyolitic, and trachytic composition, and flows and flow breccias of basaltic, basaltic andesite, and andesitic composition (Reynolds, 1980). Small intrusions of the above compositions are also present. The volcanic rocks are interbedded with red sand and gravel fluvial deposits, massive fanglomerates, and lacustrine deposits with local organic-rich facies, algal limestones, and water-laid tuffs. It is within such beds that the well-known uranium deposit of the Anderson Mine is located (Sherborne et al., 1979).

The upper unit consists of grayish brown, poorly consolidated sandstones, fanglomerates, mudstones, and water-laid tuffs. The rocks contain abundant volcanic debris. They are overlain and intercalated with basaltic volcanics. Mudstones in lacustrine deposits contain fresh water ostracods.

The mid-Tertiary rocks rest unconformably on Precambrian, Paleozoic, Mesozoic, and Laramide rocks. They were deposited in northwest-striking basins which were tilted northeastward and southwestward as shown in Figure 2 (Scarborough and Wilt, 1979).

The mid-Tertiary volcanic rocks lie mainly in the middle unit, but they do extend into the lower and upper units. The volcanism was extremely voluminous, and in southwestern Arizona, about a million cubic kilometers were emptied (Shafiqullah et al., 1980). These may have been largely emptied from cauldrons such as have been identified in the Datil volcanics in southwestern New Mexico by Elston (1978) and Elston and Bornhorst (1979). However, no such cauldrons have been identified in southwestern Arizona to date. The volcanism lasted from 35 m.y.B.P. to about 12 m.y.B.P. with the interval between 24 and 12 m.y.B.P. being the transition from the mid-Tertiary orogeny to Basin and Range faulting, which did not take place simultaneously throughout southwestern Arizona (Shafiqullah et al., 1980). In western Arizona, the intensity of volcanism peaked about 21 m.y.B.P. as the volcanic arc swept from east to west during the steepening of the Benioff zone in the late Oligocene and early Miocene (Coney and Reynolds, 1977). The volcanism was calc-alkaline; but as the main magmatic arc passed westward, it became highly potassic with eruption of potassic trachyandesites and ultra-potassic trachytes (Shafiqullah et al., 1980). Towards the close of the mid-Tertiary orogeny, volcanism became almost entirely basaltic.

Mid-Tertiary rocks crop out extensively in the ranges of the Kofa GRA. Volcanic rocks, probably mainly within the middle unit of the mid-Tertiary rocks, are the most abundant and form part of the extrusive Kofa volcanic field (Scarborough, 1979). In Figure 3, the volcanic rocks are divided into rhyolitic, andesitic, basaltic and undifferentiated volcanic rocks, intermediate rocks, and intrusive rocks, largely after Wilson et al. (1969). Available radiometric dates are also plotted on Figure 3 and all volcanic rocks that are shown are mid-Tertiary. Mid-Tertiary sediments of the lower and upper units are not nearly as extensively exposed. They crop out in the northern Plomosa Mountains in the Brenda sub-area, in the central portion of the Eagle Tail sub-area, and at the eastern end of the Gila Bend Mountains in the Saddle sub-area. The mid-Tertiary rocks underly much of the valley-fill sediments that were deposited during and after Basin and Range faulting (Eberly and Stanley, 1978). Reporting results of a seismic profile that crosses the Saddle sub-area from the southwest to the northeast corner, Eberly and Stanley (1978) show that about 1,500 feet of middle unit volcanics and about 600 feet of upper unit clastics underlie the valley-fill sediments.

Tertiary sections have been examined in some detail in the northern part of the Brenda sub-area, the east-central portion of the Eagle Tail sub-area, and the west-central and southeastern parts of the Saddle sub-area by Scarborough and Wilt (1979).

In the north-central area of the Brenda sub-area, the area is located on the northeastern flank of the Plomosa Mountains (T 6N, R 17W). Basement is Precambrian gneiss which is overlain by 100 feet of arkose, 200 feet of thinly bedded calcareous shale and limestone, several hundred feet of andesitic flows, and a capping of rhyolitic welded tuff. The beds dip south and are overridden by a very thin sheet of Mesozoic schist.

In the east-central portion of the Eagle Tail sub-area, the area is located at the western end of the Gila Bend Mountains (T 2S, R 11 and 12W). Basement consists of gneissic granite which is overlain by a rhyolitic ash flow deposit. Elsewhere in the area, a biotite rhyolite up to 10 feet thick is overlain by 60 to 120 feet of red-brown arkosic sandstone interbedded with minor dark limestone and mudstone, rhyolitic breccias and tuffs up to 60 feet thick, and 8 to 12 feet of cherty limestone. The rocks are complexly faulted and have variable dip.

In the west-central part of the Saddle, the area is located in the western Gila Bend Mountains (T 2S, R 9W). Basement is a foliated granodiorite intruded by diabase dikes. It is unconformably overlain by welded tuff; arkosic sandstone and conglomerates interbedded with thin, fetid limestone beds; and basaltic andesite flows. The sediments are preserved in several fault angle depressions and dip to the northeast.

In the southeastern part of the Saddle sub-area, the area is located near Gila Bend (T 5S, R 5W). Basement is granite intruded by pegmatites. It is unconformably overlain by 500 to 1,000 feet of well-sorted, crossbedded, red-brown, aeolian or fluvial sands; 1,000 to 2,000 feet of fanglomerate interbedded with fluvial sandstone; and by rhyolitic and dacitic welded tuffs, possibly interlayered with mudstone. The sediments dip to the southwest.

Late Tertiary

Late Tertiary deposits are found in all the tectonic basins that formed during the Basin and Range disturbance. The depth of these basins have been estimated by Oppenheimer and Sumner (1980) through gravity modelling and drillhole data and are shown in Figures 3 through 7 and summarized in Figure 1 of this report. The depths of these basins are highly variable but those that are deeper than 1,000 feet include: the Castle Dome Plain, the King Valley, and the northwest corner of the Cibola sub-area; the La Posa and Ranegras Plains in the Brenda sub-area; the Polomas, Ranegras, and Harquahula Plains in the Eagle Tail sub-area; and the northeast corner of the Saddle sub-area.

The deposits consist mainly of poorly consolidated, tan colored fanglomerate, sandstone and siltstone of fluvial and lacustrine origin, and minor basalt (Scarborough and Wilt, 1979; Reynolds, 1980). In the northwest corner of the Cibola sub-area along the Colorado River, marine sediments of the Bouse Formation are present (Metzger, 1967, 1968). The sediments consist of a basal limestone which contains foraminifers, mollusks, ostracods, clarophytes, and barnacles and is up to 100 feet thick. Near Cibola, this is overlain by about 200 feet of claystone interbedded with silt, fine-grained sand and gravel. The claystone is pale olive and swells when moistened. These sediments were deposited in an embayment of the Gulf of California during the Pliocene.

The Late Tertiary sediments rest unconformably on mid-Tertiary, or older, rocks. In the Cibola sub-area, the Bouse Formation rests on a fanglomerate (Metzger, 1967) which may be the clastic upper unit of the mid-Tertiary sequence.

The initiation of Basin and Range faulting and deposition of basin-fill sediments took place 13 to 12 m.y.B.P. according to Eberly and Stanley (1978). Shafiqullah et al. (1980), however, present evidence to show that the transition from the mid-Tertiary orogeny to the Basin and Range disturbance took place over the time interval between 19 and 12 m.y.B.P., and that the basaltic volcanism decreased in intensity from 9 to 4 m.y.B.P. The interval during which Basin and Range tectonism, volcanic activity, and sedimentation was dominant in southwest Arizona was probably 14 - 4 m.y.B.P. (Shafiqullah, 1980), although some basaltic volcanism is as young as 1 m.y.B.P.

Latest Tertiary and Quaternary

During the last four million years, volcanic and tectonic activity has slowed in southwestern Arizona. The dominant geological processes have been erosion of ranges and formation of extensive pediments, deposition of fanglomerates, and deposition of alluvium, mainly along the Colorado River and the Gila River. Basalts have been emptied in the southern and western portions of the Saddle sub-area between 3.2 and 1.35 m.y.B.P. Several warm springs are present at Agua Caliente just southwest of the Saddle sub-area (Waring, 1965). The springs are 37 - 40°C and are associated with Quaternary basalt.

Structural Geology

The GRA lies within the North American craton and east of the Wasatch Line and has been affected by tectonism during Proterozoic, mid-Mesozoic, Laramide and mid-Tertiary orogenies and most recently by the Basin and Range disturbance. The area is, therefore, structurally very complex. It is only recently, and largely as a result of detailed structural studies and extensive radiometric dating, that the structure and tectonics of the area has begun to be understood. Particularly important recent studies include strain analysis of various deformations by Davis (1981) and a summary of recent radiometric dates by Shafiqullah et al. (1980).

During the Arizona n revolution, 1.76 to 1.63 b.y.B.P. (Damon, 1968), the Precambrian rocks were folded about ENE-striking axes and underwent N-S to NNW faulting (Davis, 1981). The Colorado lineament (see Figure 2), a major strike slip system, according to Warner, was initiated about this time and its southwestern extension passes to the northwest of the GRA.

No pronounced tectonic or igneous activity took place during the Paleozoic, but southwestern Arizona was strongly affected by a mid-Mesozoic magmatic arc and a later period of metamorph ism and folding. The magmatic arc extended across southwestern Arizona (see Figure 2) during mid-Jurassic and produced voluminous volcanism and granitic plutonism. The area underwent folding and metamorphism after deposition of molasse-like sediments and prior to the Laramide orogeny; these rocks are preserved in the Kofa GRA. Northwest-trending strike slip faulting ws initiated (Davis, 1981) and movement along the Mojave-Sonora left-lateral megashear (see figure 2) probably took place at this time (Silver and Anderson, 1974). Northwest-trending linear discontinuities in depositional patterns (see figure 2) were produced in southeastern Arizona (Titley, 1976).

The Laramide was a period of intense tectonism and localized magmatic activity which were associated with the southeastward migration of the magmatic arc (Coney and Reynolds, 1977; Lowell, 1974). The Laramide basement-cored uplifts and thrust faults which strike NNW to NW (Nielsen, 1979; Davis, 1980); the WNW left-lateral strike slip faulting of the Texas zone of Schmitt (1966); and the ENE-striking tensional features (Rehrig and Heidrick, 1976) are all probably related to ENE plate motion and compression. Laramide plutons associated with porphyry copper mineralization have a pronounced NNW to NW trend and a secondary ENE trend (Heidrick and Titley, 1982; see Figure 2). The former is parallel to the Laramide magmatic arc and basement-cored uplifts, and the latter is parallel to Precambrian fold axes and Laramide tensional features. One of the ENE trends passes through the southern part of the Kofa GRA (see Figure 2).

The mid-Tertiary orogeny lasted approximately from 34 to 14 m.y.B.P. (Shafiqullah et al., 1980) and involved eruption of large volumes of volcanic rocks, emplacement of metamorphic core complexes, and listric normal faulting. These geologic events accompanied the steepening of the Benioff zone and the resultant westward migration of the magmatic arc (Coney and Reynolds, 1977).

The volcanism produced enormous volumes of ignimbrite eruptions and was dominantly calc-alkalic but became potassic in the later stages. In southwestern New Mexico, similar volcanics originated from numerous cauldrons (Elston and Bornhorst, 1979). Cauldrons may be present in southwestern Arizona but none have been located to date. Thick sections of volcanics in the Kofa GRA suggest that such structures could be present there.

The metamorphic core complexes are characterized by mylonitic augen gneiss and an overlying brittle fracture zone separated by a dislocation surface from an allochthonous upper plate which is unmetamorphosed (Davis and Coney, 1979; Coney, 1980; Rehrig and Reynolds, 1980). The mylonitic foliation defines gently dipping, NE- to ENE-striking domes which have physiographic expression. The mylonitic rocks have a pronounced NE-to-ENE lineation which is developed parallel to the direction of extension in the lower plate. Most workers agree that the metamorphic core complexes indeed formed as a response to extension in a NE-SW to ENE-WSW direction. Davis (1980) considers the complexes as megaboudins, whereas Rehrig and Reynolds (1980) consider that the complexes developed in areas of high heat flow between separating blocks. The relationship of the core complexes to the coeval volcanism is not known. Metamorphic core complexes lie just to the north and east of the Brenda sub-area, and their structural effect may be felt in the GRA.

Listric normal faulting is common in the upper plates of metamorphic core complexes. The faults merge downward into the dislocation surface. The faults generally strike northwest and are spoon-shaped, gravity-like faults that typically involve Oligocene and mid-Miocene rocks (Davis, 1981).

About 14 m.y.B.P., a transition occurred between listric faulting and Basin and Range normal faulting. Basin and Range faults strike NW to N-S (see Figure 1) and are high-angle faults (Davis, 1981). The present day ranges and basins result from this tectonic episode which was terminated in much of southwestern Arizona about 4 m.y.B.P.

Paleontological Documentation

Paleontological documentation is important for three major reasons, as follows:

a) guide fossils, which in the sedimentary sequence are most useful for stratigraphic correlation,

b) outstanding fossil specimens or fossils which are extraordinarily preserved can be beneficial to science and/or tourism, and

c) fossils can be excellent indicators of the paleogeographic and paleoecological environments; as a result, even moderately to poorly preserved, "uninteresting" fossils can be important geologically.

Plant fossils must also be considered important as organic material can trigger the precipitation of uranium and other metals.

The following is a brief summary of the sedimentary formations of the Kofa GRA and its enclosed WSAs, including a list of fossils known to occur in those rocks. To the authors' knowledge, there are no fossil localities of outstanding importance or interest. A list of some of the more common and abundant marine fossils of Arizona is provided by Wilson (1962, p. 111-112) and may include some fossils found in the area. Unfortunately, little specific information has been reported about fossils ocurring in rocks of the Kofa GRA.

Older Precambrian rocks include those possibly correlative with the Yavapai Series, a greenstone belt, and the metasedimentary Pinal Schist. It is not impossible that fossils occurring in the original sedimentary rocks may have survived metamorphism. Precambrian metamorphic rocks crop out in the Clanton Well (020-129), Face Mountain (020-136), and Signal Mountain (020138) WSAs.

No fossils are reported to occur in the Cambrian Bolsa Quartzite. Heindl and McClymonds (1964) state that trilobites are known to occur in other areas of outcrop of the Cambrian Abrigo Formation, which is comprised of sandy shale interbedded with quartzite. Outside of the Kofa GRA, the Martin Formation of Devonian age is divided into two members, a lower member containing coalified plant material and a brachiopod, gastropod, ostracod and fish-bearing upper member (Teichert, 1965). The Mississippian Escabrosa Limestone contains crinoids, coral, bryozoans and brachiopods in other areas of outcrop in Arizona. The quartzite and interbedded limestone and mudstone of the Pennsylvanian-Permian Supai Formation is not reported to be fossil-bearing in this region, as is true of the Permian Coconino Sandstone and Kaibab Limestone. In the Kofa GRA, undifferentiated Paleozoic sediments, with no reported fossil occurrences, crop out only in the New Water Mountains (020-125) WSA and adjoining parts of the Brenda sub-area.

Mesozoic sediments of the GRA include mid-Mesozoic volcanic conglomerate, sandstone and red mudstone and late Mesozoic clastics. The late Mesozoic clastics are comprised of cyclothemic basal red beds of fluvial and playa deposition and the conformable conglomerate, sandstone and siltstone of the Livingston Hills Formation. No fossils are reported to occur in the sediments and their metamorphosed equivalents which crop out in the Trigo Mountains (050-023B), South Trigo Mountains (050-023A) and New Water Mountains (020-125) WSAs.

Sediments of the lowest mid-Tertiary unit of Eberly and Stanley (1978) and Scarborough and Wilt (1979) include algal limestones. Sediments which are interbedded with volcanics of the middle unit include lacustrine deposits with local organic-rich facies as well as algal limestones. Mudstones of the upper unit contain fresh water ostracods. Late Tertiary sediments, comprised of poorly consolidated fanglomerate plus sandstone and siltstone of fluvial lacustrine origin, are not known to contain fossils. Mid- and late Tertiary rocks which may contain some of the above-mentioned sediments and fossils crop out in all the WSAs except the Kofa Unit 4 Southern Addition (050-034) WSA. The Pliocene Bouse Formation, a marine unit with foraminifers, mollusks, ostracods, charophytes, and barnacles, crops out in the Trigo Mountains (050-023B) WSA.

Late Tertiary and Quaternary fanglomerates and alluvium are not known to contain fossils. These sediments occur in all the WSAs except South Trigo Mountains (050-023A) and Eagle Tail Mountains (020-128) WSAs.

Geologic History and Paleogeographic Development

The geologic history of the area is long and complex, and only a brief synopsis is presented here. Excellent summaries of the main geological events that affected the southern Cordillera of North America are given by Burchfiel (1979) and Dickinson (1981). More detailed accounts pertaining particularly to southwestern Arizona are given by Shafiqullah et al. (1980) and Reynolds (1980). The geologic history can be summarized as follows:

1. Volcanic and clastic rocks were accreted onto the North American craton 1.8 to 1.6 b.y.B.P. from the southeast (Anderson, 1976; Anderson and Silver, 1976; Silver, 1978; Titley, 1982). The boundary between the dominantly volcanic and volcanoclastic Yavapai Series and the clastic nonvolcanic Pinal Schists coincides with the Holbrook Linear (Titley, 1982; see Figure 2), the extension of which passes through the Saddle sub-area of the Kofa GRA. The rocks were folded around northeasterly axes, metamorphosed and intruded by granites 1.7 to 1.6 b.y.B.P. (Damon, 1968), and then intruded by anorogenic granites 1.5 to 1.4 b.y.B.P. (Damon, 1968; Silver et al., 1977).
2. Some time after this, the area was uplifted and eroded. The area to the east of the Kofa GRA was then submerged beneath epicontinental seas, and shallow marine clastic sediments and minor carbonates of the late Proterozoic Apache Group were deposited. Apparently, the area covered by the GRA remained above sea level at this time.
3. During the Cambrian, the western part of the GRA was submerged beneath epicontinental seas, and shallow marine sandstones and sandy mudstones were deposited (Miller, 1970; Reynolds, 1980).
4. No desposition took place during the Ordovician and Silurian, and the Cambrian is disconformably overlain by a thick sequence of Devonian to Permian shallow marine carbonates and sandstones (Miller, 1970; Reynolds, 1980).
5. During the mid-Mesozoic, a magmatic arc extended over much of the GRA (see Figure 2) and produced voluminous intermediate to felsic

volcanics and minor intrusives (Reynolds, 1980). The Benioff zone then steepened, the magmatic arc moved west (Coney and Reynolds, 1977), and a thick sequence of continental molasse-like sediments, some of which are distinctly red, were deposited (Robinson, 1980; Harding, 1980). The Mesozoic volcanics and sediments were folded and metamorphosed prior to the Laramide (Rehrig and Reynolds, 1980).

6. The Laramide was a period of intense tectonic activity characterized by NNW- to NW-striking basement-cored uplifts and thrust faults (Nielsen, 1979; Davis, 1981), WNW-trending left-lateral faults of the Texas basement zone (Schmitt, 1966), ENE-striking tensional fractures (Rehrig and Heidrick, 1976), and intrusion of granitic plutons, which in southeastern Arizona are epizonal and are located along NW and ENE trends (Heidrick and Titley, 1982). In southwestern Arizona and in the GRA, the Laramide plutons crystallized at moderate depths and have characteristics of S-type granites. The Laramide magmatic activity proceeded from northwest to southeast as the dip of the Benioff zone flattened during the time interval from 70 to 50 m.y.B.P. (Coney and Reynolds, 1977).
7. The Laramide was followed by a period of tectonic quiet during which erosion proceeded.
8. The mid-Tertiary orogeny lasted from approximately 35 to 14 m.y.B.P. During this time, a great thickness of fluvial and lacustrine sediments interbedded with voluminous felsic to intermediate volcanics were deposited in northwest-striking basins (Eberly and Stanley, 1978; Scarborough and Wilt, 1979). The volcanism was mainly calc-alkalic to potassic (Shafiqullah et al., 1980) and was dominated by ignimbrite eruptions, possibly related to cauldrons.

Coeval with the volcanism was the emplacement of metamorphic core complexes which occur along a northwest-trending zone (Coney, 1980) largely to the north and east of the GRA. Associated with the core complexes, and also present elsewhere in southwestern Arizona, are present listric normal faults (Davis, 1981) which offset mid-Tertiary volcanic and sedimentary rocks. Volcanism and tectonism migrated westward during the mid-Tertiary as the dip of the Benioff zone steepened (Coney and Reynolds, 1977).

9. After the westward passage of the magmatic arc, listric faulting gave way to steep, normal Basin and Range faulting which became dominant after 14 m.y.B.P. (Shafiqullah et al., 1980). At this time, volcanism became entirely basaltic, the present ranges were uplifted, and the basins were filled with fluvial, lacustrine and locally marine sediments.
10. Since 4 m.y.B.P., volcanism and tectonism have been minor (Shafiqullah et al., 1980), and the dominant geologic process has been erosion of ranges with formation of extensive pediments and deposition of extensive fans in the basins and floodplain deposits along the major rivers.

ENERGY AND MINERAL RESOURCES

The following are descriptions of known mineral deposits, occurrences, mineralized areas, thermal wells and other energy resources (Figures 3 through 7) in the Kofa GRA. Information was derived principally from the U.S. Geological Survey (1972, revised in 1979 - the CRIB file) and Keith (1978). Bureau of Land Management files, Witcher et al. (1982), Scarborough and Wilt (1979), Johnson (1972), Arizona Bureau of Mines (1969), Keith (1969a, 1969b), Koschmann and Bergendahl (1968), Stipp et al. (1967), McCrory and O'Haire (1965), Walker and Osterwald (1963), Granger and Raup (1962), Jaster (1956), Wilson and Roseveare (1949), Wilson (1941, 1933), Allen (1922), and Allen and Butler (1921) all provided information used in the following descriptions. Data from the U.S. Bureau of Mines (1982, MILS), Chew and Antrim (1982), and Karfunkel (1982) are also included. These descriptions represent a summary of the knowledge regarding individual mines and occurrences that is available to the authors.

Known Mineral Deposits, Mines or Prospects with Recorded Production

1. Hardt Mine

Other Name:	Hart Mine (name on USGS 1:250,000 topographic map).
Location:	33°17'39"N, 114°35'10"W NE-1/4 SW-1/4 Sec. 36, T 1S, R 23W, Gila and Salt River Meridian
Commodities:	Au, Cu, Fe Major Product: Au Occurrences: Cu, Fe
Ore Materials:	Gold, hematite, limonite, pyrite, ferruginous calcite
Description of Deposit:	8-inch wide, 300-foot long (maximum), N55°W-trending vein dips 65°NE. Workings: inclined shaft and open cuts.
Geology:	Mineralization is along a fault in schist. Tertiary granite porphyry intrudes the schist.
Production:	Small amount
References:	USGS CRIB Mineral Resources File 12, Record 2680, p. 6813-6815; USGS CRIB Mineral Resources File 12, Record 2806, p. 7162-7163; USGS Map MR-46; ABMMT Bulletin 192.

7. Trigo Placers

Location:	33°16'35"N, 114°35'46"W Secs. 1, 2, 3, 10, 11, 12, 14, and 15, T 2S, R 23W, Gila and Salt River Meridian
Commodity:	Gold
Ore Materials:	Unknown
Description of Deposit and Geology:	Placer deposits are in washes draining the Hardt Gold Mine and other gold mines.
Production:	Less than 10,000 oz.
Reference:	Johnson, 1972.
Note:	Latitude and longitude given is that of symbol in Figure 3 which approximates center of district.

9. **H.H. and L. Mine Group**
Other Names: Cass, New Year Nos. 2 and 3
Location: 33°11'35"N, 114°37'01"W
Secs. 3 and 4, T 3S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Psilomelane, pyrolusite
Description of Deposit and Geology:
Irregular, disconnected masses and veinlets in brecciated and silicified Tertiary andesite, along a fault zone.
Production: A few hundred tons of 20-40% Mn ore.
Reference: Keith, 1978, ABMMT Bulletin 192.

10. **Cibola No. 1 Mine**
Location: 33°11'36"N, 114°36'06"W
Sec. 2, T 3S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Pyrolusite, manganite, psilomelane
Description of Deposit and Geology:
Ore occurs as lenticular shoots, fracture fillings and narrow seams in brecciated wallrock in broad sheared fault contact between Mesozoic granitic schist and Tertiary andesite. Gangue: calcite and quartz
Production: 2,000 long tons of 30% Mn ore.
Reference: Keith, 1978, ABMMT Bulletin 192.

11. **Peggy B. Mine**
Location: 33°11'54"N, 114°36'45"W
Sec. 3, T 3S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Ore Material: Pyrolusite
Description of Deposit and Geology:
Lenticular shoots in brecciated wallrock along fracture in Tertiary andesites.
Production: 100 tons of 20-30% Mn ore.
Reference: Keith, 1978, ABMMT Bulletin 192.

12. **Triple H Mine Group**
Other Name: J.P., Rosie
Location: 33°12'22"N, 114°36'42"W
Secs. 34 and 35, T 2S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Mn oxides
Description of Deposit and Geology:
Irregular bunches and lenses along fracture zone in Tertiary andesitic volcanics.
Production: 1954-1959: produced 2,000 long tons of low-grade Mn ore.
Reference: Keith, 1978, ABMMT Bulletin 192.

13. **Cibola No. 3 Mine**
Location: 33°12'35"N, 114°35'55"W
Sec. 35, T 2S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Pyrolusite, manganite, psilomelane
Description of Deposit and Geology:
Irregular shoots in a lensing brecciated zone in Tertiary andesitic volcanics.
Production: 500 tons of 30-40% Mn ore.
Reference: Keith, 1978, ABMMT Bulletin 192.

14. **Cibola Nos. 7 and 8**
Location: 33°13'26"N, 114°35'06"W
Sec. 25, T 2S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Ore Material: Pyrolusite
Description of Deposit and Geology:
Discontinuous lenticular bodies along fracture zone in Tertiary andesitic volcanics.
Production: No. 7: 4,000 long tons of 30% Mn ore; No. 8: 3,000 long tons of 25-30% Mn ore.
Reference: Keith, 1978, ABMMT Bulletin 192.

16. **Black Diamond Mine Group**
Location: 33°13'17"N, 114°32'56"W
Sec. 29, T 2S, R 22W, Gila and Salt River Meridian
Commodities: Mn, Pb; Zn
Major Products: Mn, Pb
Minor Product: Zn
Ore Materials: Pyrolusite, psilomelane
Description of Deposit and Geology:
Lenticular shoots along a brecciated shear zone in Tertiary andesite porphyry.
Production: 1953-1959: 4,600 long tons of 40% Mn and 9,000 long tons of 30% Mn ore.
Reference: Keith, 1978, ABMMT Bulletin 192.

17. **Andrus Claims**
Other Name: M & A
Location: 33°13'48"N, 114°32'50"W
SE-1/4 Sec. 20, T 2S, R 22W, Gila and Salt River Meridian
Commodity: Mn
Ore Material: Psilomelane
Description of Deposit and Geology:
Mineralization is in bunches and veinlets along a fracture zone in Tertiary andesites.
Production: 50-100 long tons of 40% Mn ore shipped.
Reference: Keith, 1978, ABMMT Bulletin 192.

18. **Black Jack Mine**

Location: 33°14'40"N, 114°34'58"W
Sec. 13, T 2S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Mn oxides
Description of Deposit and Geology:
Mineralization in disconnected lenticular bodies along brecciated fracture zone in Tertiary andesite.
Production: 2,000 long tons averaging 30% Mn produced in early 1950s.
Reference: Keith, 1978, ABMMT Bulletin 192.

22. **Colorado River Placers**

Location: 33°07'17"N, 114°41'41"W
Secs. 25, 26, 35, and 36, T 3S, R 24W; and Secs. 1, 2, and 11, T 4S, R 2W; Gila and Salt River Meridian
Commodity: Au
Ore Materials: Unknown
Description of Deposit: Gold placer deposits are present in stream gravels and terraces of the Colorado River Valley.
Geology: Unknown
Production: About 1,160 oz. Au and 100 oz. Au.
Reference: Johnson, 1972, USGS Bulletin 1355.
Note: Latitude and longitude given is that of symbol at center of district.

25. **Silver Clip Mine**

Other Name: Blaine
Location: 33°08'09"N, 114°35'05"W
Sec. 25, T 3S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Pb, V, Cu, Ba, Mn
Major Product: Ag
Minor Product: Pb
Occurrences: V, Cu, Ba, Mn
Ore Materials: Cerargyrite, Pb oxide, cerussite, malachite, vanadinite, barite, pyrolusite, hematite
Description of Deposit: Small vein (700 feet long, 1 to 8 feet wide, 120 feet deep) trending N30°E and dipping 70°W. Workings: underground.
Geology: Vein occurs within a fault zone in Tertiary andesite flows, tuff, and breccia.
Production: $1,113,600 worth of silver was produced between 1883 and 1929.
References: USGS CRIB Mineral Resources File 12, Record 2700, p. 6865-6867; Arizona Bureau of Mines Bulletin 180; USGS Map MR-46; Wilson, 1933, Arizona Bureau of Mines Bulletin 134.

26. Amelia Mine

Other Names: Gallo, Revelation

Location: 33°07'45"N, 114°35'04"W
Secs. 25 and 26, T 3S, R 23W, Gila and Salt River Meridian

Commodities: Ag, Pb, Ba, Mn, Zn, Sr, Fe
Major Products: Ag, Pb
Minor Product: Ba
Occurrences: Mn, Zn, Sr, Fe

Ore Materials: Cerussite, Zn and Pb carbonates, barite, hematite, Fe and Mn oxides, celestite

Description of Deposit: Small N35°W-trending, 60°E dipping, pinch-and-swell vein. Workings: adit with raises, winzes, and one stope.

Geology: Vein is in a fault in Mesozoic schist.

Production: Small amount

References: USGS CRIB Mineral Resources File 12, Record 2699, p. 6862-6864; Wilson, 1933, Arizona Bureau of Mines Bulletin 134.

29. Dives Mine

Other Names: Saxon, Padre Kind

Location: 33°07'05"N, 114°35'12"W
SW-1/4 Sec. 36, T 3S, R 23W, Gila and Salt River Meridian

Commodities: Ag, Pb, Zn, Mn, Sr, Ba, Fe
Major Product: Ag
Minor Product: Pb
Occurrences: Zn, Mn, Sr, Ba, Fe

Ore Materials: Pb oxide, cerussite, smithsonite, hematite, pyrolusite, barite

Description of Deposit: Vugs and irregular masses in a shear zone striking N20°W and dipping 60°SW. Workings: vertical shaft, adits, and open pits. All production is from pits.

Geology: Mineralization is in a fault separating Mesozoic schist and Tertiary granite from Tertiary andesitic and rhyolitic flows, tuffs, and breccias.

Production: Small amount

References: USGS CRIB Mineral Resources File 12, Record 2702, p. 6871-6873; Wilson, 1933, Arizona Bureau of Mines Bulletin 134.

31. Red Cloud Mine

Location: 33°06'05"N, 114°35'56"W
SE-1/2 Sec. 11, T 4S, R 23W, Gila and Salt River Meridian. This location differs slightly from USGS CRIB location.

Commodities: Ag, Pb, Au, Cu, Mn, Zn, V, W
Major Products: Ag, Pb
Minor Products: Au, Cu
Occurrences: Mn, Zn, V, W

Ore Materials: Silver chloride, vanadinite, wulfenite, cerussite, pyrolusite, malachite, smithsonite, galena

31. Red Cloud Mine (Continued)

Description of Deposit: Small (100 feet long, 6 feet wide, 410 feet deep) N15°W-trending, 45°E-dipping vein. Workings: shafts, drifts, and stopes.

Geology: Mineralization is along a fault separating Tertiary felsic lavas and intrusives.

Production: Once a major producter of lead and silver in the Silver (Eureka) District.

References: USGS CRIB Mineral Resources File 12, Record 2741, p. 6980-6982; Arizona Bureau of Mines Bulletin 180; USGS Map MR-46; ABMMT Bulletin 192; Karfunkel, 1982.

32. Princess Mine:

Other Names: Hamburg, Blake

Location: 33°06'22"N, 114°35'03"W
Sec. 1, T 4S, R 23W, Gila and Salt River Meridian

Commodities: Ag, Pb, Zn, Sr, Mo, V, Ba, F, Fe, W
Major Product: Ag
Minor Products: Pb, Zn
Occurrences: Sr, Mo, V, Ba, F, Fe, W

Ore Materials: Pb oxide, anglesite, cerussite, hematite, vanadinite, smithsonite

Description of Deposit: Small NNW-trending, 30°SW-dipping vein. Workings: inclined shaft.

Geology: Mineralization along fault in Tertiary granite and Mesozoic schist. Calcite, barite, celestite, quartz, and fluorite are also present.

Production: Yes

References: USGS CRIB Mineral Resources File 12, Record 2735 and 2738, p. 6962-6964 and 6971-6973; USGS Map MR-46.

33. Silver King

Location: 33°06'18"N, 114°34'53"W
Sec. 1, T 4S, R 23W, Gila and Salt River Meridian

Commodities: Ag, Pb, Zn, Mo, V, Sr, Cu
Major Product: Ag
Minor Products: Pb, Zn
Occurrences: Mo, V, Sr, Cu
Also Present: Fe, Ba, F
2735 and 2738, p. 6962-6964 and 6971-6973; USGS Map MR-46.

Ore Materials: Galena, Pb oxide, cerussite, hematite, anglesite, wulfenite

Description of Deposit: Small NW-trending, 40°NE-dipping vein deposit. Workings: shaft and adits.

Geology: Mineralization is along a fault in Tertiary granite and Mesozoic schist.

Production: Small

Reference: USGS CRIB Mineral Resources File 12, Record 2736, p. 6965-6967.

34. **Pacific And Mandan Claims**

Location: 33°05'31"N, 114°35'46"W
Sec. 11, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Pb, Fe, Mn
Major Product: Ag
Minor Product: Pb
Occurrences: Fe, Mn
Ore Materials: Galena, pyrolusite, hematite
Description of Deposit: Vugs and irregular masses on small NW-trending, 85°E-dipping vein. Workings: shafts and surface cuts.
Geology: Mineralization is along fault in Mesozoic schist intruded by Tertiary granite.
Production: Yes
Reference: USGS CRIB Mineral Resources File 12, Record 2720, p. 6977-6979.

35. **Papago Mine**

Location: 33°05'27"N, 114°35'55"W
S-1/2 Sec. 11, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Pb, V, W, Zn, Mn, Mo
Major Product: Ag
Minor Product: Pb
Occurrences: V, W, Zn, Mn, Mo
Ore Materials: Ag chloride, vanadinite, wulfenite
Description of Deposit: Small vein deposit. Workings: 4 or more shafts.
Geology: Mineralization is along a fault separating Tertiary granite from Tertiary andesitic flows and tuffs. Gangue: Fe oxides, quartz, fluorite and calcite.
Production: Small
Reference: USGS CRIB Mineral Resources File 12, Record 2742, p. 6983-6985.

36. **Black Rock Mine**

Location: 33°05'24"N, 114°35'37"W
Sec. 11 and 12, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Pb, Zn, F
Major Products: Ag, Pb, Zn
Occurrence: F
Ore Materials: Galena, Pb oxides, cerussite, anglesite, pyrolusite, smithsonite
Description of Deposit: Small (2,000 feet long, 18 feet maximum width) N65°W-trending, 40°NE-dipping vein. Workings: shaft, adit, and surface cuts.
Geology: Mineralization is along fault zone in Mesozoic schist.
Production: Once one of the largest producers of silver and lead in the Silver (Eureka) District.
References: USGS CRIB Mineral Resources File 12, Record

36. Black Rock Mine (Continued)
2743, p. 6986-6988; Arizona Bureau of Mines Bulletin 180; USGS Map MR-46; ABMMT Bulletin 192.

40. **River View Claims**
Other Names: Eureka, Old Selby, Bonanza
Location: 33°02'25"N, 114°33'50"W
Sec. 31, T 4S, R 22W, Gila and Salt River Meridian
Commodities: Ag, Pb, Au, Zn, Fe
Major Products: Ag, Pb
Minor Products: Au, Zn
Occurrence: Fe
Ore Materials: Galena, sphalerite, cerussite, smithsonite
Description of Deposit: Small N70°E-striking, 40°NW-dipping vein deposit. Workings: underground.
Geology: Vein is filling fault in Mesozoic quartz-sericite schist which has been intruded by Tertiary aplite dikes. Also present are manganiferous to ferruginous calcite, quartz, and hematite.
Production: Small production of high-grade ore
References: USGS CRIB Mineral Resources File 12, Record 2734, p. 6959-6961; ABMMT Bulletin 192.

41. **Mendevil Claims**
Location: 33°02'25"N, 114°32'56"W
Sec. 32, T 4S, R 22W, Gila and Salt River Meridian. Approximate location; based on sketchy description.
Commodities: Ag, Pb
Ore Material: Argentiferous galena
Description of Deposit: ENE-striking veins.
Geology: Mineralization is in fault zone in quartz-sericite schist.
Production: Small
Reference: Wilson, 1933, Arizona Bureau of Mines Bulletin 134.
Note: Another deposit, located in Sec. 36, T 3S, R 2W, is named Mendevil Prospect (#Ag 30). These are two different sets of claims that were owned by Ysidro Mendevil.

55. **Silver And Eureka (Mining Districts)**
Location: 33°06'N, 114°36'W
T 3S, R 23W; T 4S, R 23W; T 4S, R 22W; Gila and Salt River Meridian
Commodities: Ag, Au, Pb, Zn, W, Mn, V, Mo, Bi, Ba, F, Cu
Ore Materials: Argentiferous galena; cerargyrite; Fe, Pb, and Zn oxides; calcite; barite; fluorite; and quartz gangue
Description of Deposit: Base-metal sulfide veins trending NNW to NNE.
Geology: Mineralization along faults cutting schist, granite intrusive into the schist, andesite, andesitic tuff

55. Silver and Eureka (Mining Districts) (Continued)

and trachyte.

Production: At least 52,343 tons ore: 1,460 tons Pb, 1.6 million oz. Ag, 940 oz. Au, 15 tons Zn; and some Cu.

References: USGS CRIB Mineral Resources File 12, Record 2651, p. 6752; Arizona Bureau of Mines Bulletin 180; Keith, 1969; McCrory and O'Haire, 1965; Keith, 1978.

60. ABC Mine

Location: 33°16'35"N, 114°29'08"W
SE-1/4 Sec. 1, T 2S, R 22W, Gila and Salt River Meridian

Commodity: Mn

Ore Material: Psilomelane

Description of Deposit and Geology:
Mineralization is in brecciated wallrock in shear zone cutting Tertiary andesitic volcanics.

Production: 400 long tons of 41% Mn sorted ore.

References: Keith, 1978, ABMMT Bulletin 192; Arizona Bureau of Mines Bulletin 180, 1969.

65. Annie Mine

Other Name: Anna

Location: 33°00'19"N, 114°20'47"W
Sec. 8, T 5S, R 20W, Gila and Salt River Meridian

Commodities: Pb, Ag, Au, Cu, Zn, Ba
Major Products: Pb, Ag
Minor Products: Au, Cu
Occurrence: Ba
Potential Product: Zn

Ore Materials: Galena, malachite, limonite, barite

Description of Deposit: Small N15°E-trending, NW-dipping vein. Workings: adit.

Geology: Mineralization is in a fault zone at contact of Tertiary diorite porphyry dike and Mesozoic shale and schist.

Production: About 20 tons of ore was produced in the 1920s.

References: USGS CRIB Mineral Resources File 12, Record 2763, p. 7042-7044; ABMMT Bulletin 192.

67. Hull or Rialto Mine

Other Names: Chief of Dome, Diana, Surprise

Location: 33°03'34"N, 114°10'37"W
Secs. 24 and 25, T 4S, R 19W, Gila and Salt River Meridian

Commodities: Pb, Ag, V, W, U, F
Major Products: Pb, Ag
Occurrences: V, W, U, F

Ore Materials: Argentiferous galena, wulfenite, uraninite, fluorite, vanadinite

Description of Deposit: Lensing veins within a N30°W, 70°NE-

67. Hull or Rialto Mine (Continued)
dipping shear zone. Workings: 7 shafts.
Geology: Shear zone is in Mesozoic shale, limestone and sandstone intruded by Tertiary diorite porphyry.
Production: 20,000 tons from 1880-1960.
References: USGS CRIB Mineral Resources File 12, Record 2725, p. 6934-6936; Keith, 1978, ABMMT Bulletin 192.

68. Buckeye Vein Group

Location: 33°02'23"N, 114°10'26"W
Center S-1/2 Sec. 25 to center S-1/2 Sec. 36, T 4S, R 19W, Gila and Salt River Meridian
Commodities: Pb, Ag, F, Ba, V, Mo, Zn, Au, Cu, As, Se, Be, Sb
Major Products: Pb, Ag, F, Ba
Minor Products: V, Mo, Zn, Au, Cu
Occurrences: As, Se, Be, Sb
Ore Materials: Argentiferous galena, anglesite, cerussite and lead oxides, fluorite, barite, hydrozincite, smithsonite, wulfenite, vanadinite, mimetite
Description of Deposit: Irregular vein. Workings: inclined shafts.
Geology: Wall rocks of Mesozoic shale are cut by diorite porphyry and rhyolite porphyry dikes. Mineralization is most intense at intersection of two dikes. Wall rocks altered to quartz and sericite, and beds are weakly pyritized.
Production: Small
References: USGS CRIB Mineral Resources File 12, Records 2724 and 2728, p. 6932-6933, 6942-6943; Keith, 1978, ABMMT Bulletin 192.
Note: Includes the following claims: Castle Dome, New Dil-New Chance No. 1, Lady Edith, and Yuma-New-Chance No. 4 (formerly covered by Hopkins, Norma, Caledona, Willaim Penn, Miller claims).

69. Cleveland Mine

Other Names: Chicago, New Cleveland, Big jim, Hope, Ruby Nos. 1 and 2
Location: 33°02'37"N, 114°09'44"W
Secs. 30 and 31, T 4S, R 18W, Gila and Salt River Meridian
Commodities: Pb, Ag, Zn, Cu, Au, Ba, F
Major Products: Pb, Ag
Minor Products: Zn, Cu, Au
Occurrences: Ba, F
Ore Materials: Galena, silver, gold, zinc mineral, copper mineral, barite, fluorite
Description of Deposit: Small vein deposit strikes N30°W and dips 80°W. Maximum length is 1,400 feet, maximum width is 3 feet, and maximum depth is 350 feet. Workings: 3 shafts and some shallow cuts.

69. Cleveland Mine (Continued)

Geology: Vein is along a fault in Mesozoic slate and impure limestone which has been intruded by Tertiary diorite.

Production: At least 2,000 tons of ore.

References: USGS CRIB Mineral Resources File 12, Record 2730, p. 6947-6949; Keith, 1978.

70. Haack Mine Group

Other Names: Haack Nos. 1 and 2, Barite-Nip No. 1, Bronza-Hardrock, Algodones-Nip No. 2, Abe No. 10

Location: 33°02'27"N, 114°09'45"W
SE-1/4 Sec. 25, T 4S, R 19W; and NW-1/4 Sec. 31; T 4S, R 18W

Commodities: Pb, Ag, Cu, F, Ba, V, Mo, Zn, Au, As, Se, Be, Sb

Ore Materials: Argentiferous galena, oxidized Cu and Au minerals, fluorite, barite

Description of Deposit: Narrow lensing fissure veins. Workings: shallow shafts, pits, and cuts.

Geology: Veins are in Mesozoic shale which has been intruded by dikes and masses of diorite and rhyolite porphyry.

Production: Yes; amount unknown.

Reference: Keith, 1978, ABMMT Bulletin 192.

71. Mabel Mine

Other Names: Mable, Puckett

Location: 33°02'08"N, 114°09'35"W
Sec. 31, T 4S, R 18W, Gila and Salt River Meridian

Commodities: Pb, Au, Ag, F, Ba, V, Mo, Cu
Major Product: Pb
Minor Products: Au, Ag
Occurrences: F, Ba, V, Mo, Cu

Ore Materials: Argentiferous galena, wulfenite, vanadinite, fluorite, barite

Description of Deposit: Small vein in shear zone.

Geology: Mineralization is along a fault in Mesozoic shales. Mesozoic sediments are intruded by Tertiary diorite porphyry.

Production: 200 tons of ore yielded 40 tons Pb, 1,600 oz. Ag, and 40 oz. Au.

References: USGS CRIB Mineral Resources File 12, Record 2729, p. 6944-6946; Keith, 1978, ABMMT Bulletin 192.

73. Flora Temple Mine

Other Names: DeLuce, Castle Dome Group

Location: 33°01'58"N, 114°10'26"W
Secs. 25 and 36, T 4S, R 19W, Gila and Salt River Meridian

Commodities: Pb, Ag

Ore Materials: Argentiferous galena, anglesite, cerussite, Pb oxide

73. Flora Temple Mine (Continued)

Description of Deposit: Lenses and shoots in a N18°W-trending, 50°E-dipping fault. Small deposit. Workings: 11 shafts, some inclined, connected by stopes.

Geology: Fault is in Mesozoic slate. Tertiary igneous rocks have intruded slate. Gangue: barite, fluorite and calcite.

Production: Produced at least 54,700 tons of ore; was one of the major producers of lead in the Castle Dome District.

References: USGS CRIB Mineral Resources File 12, Record 2726, p. 6937-6939; Arizona Bureau of Mines Bulletin 180.

74. Little Dome Mine

Other Name: Linda Extension

Location: 33°01'41"N, 114°10'02"W
Sec. 36, T 4S, R 19W; and Sec. 6, T 5S, R 18 W; Gila and Salt River Meridian

Commodities: Pb, Ag

Ore Materials: Galena, Pb oxide, cerussite, anglesite

Description of Deposit: Small N50°W, 85°SW-dipping vein. Workings: stopes.

Geology: Mineralization is along fault in Mesozoic slate intruded by Tertiary diorite porphyry dike. Fluorite, calcite, barite, sericite, and quartz are present.

Production: Small amount

Reference: USGS CRIB Mineral Resources File 12, Record 2759, p. 7030-7032.

75. Adams Mine Group

Other Names: Dandy Boy Group, Puzzler, Silver Dollar

Location: 33°01'50"N, 114°09'23"W
S-1/2 Sec. 31, T 4S, R 18W, Gila and Salt River Meridian

Commodities: Pb, Ag, Au, Cu, V, Mo F
Major Products: Pb, Ag
Minor Products: Au, Cu
Occurrences: V, Mo, F

Ore Materials: Galena, anglesite, Pb oxide, fluorite, cerussite, vanadinite, wulfenite, Fe oxide, calcite

Description of Deposit: Small vein (8 feet maximimum width) strikes N23°W and dips 70°NE. Workings: 4 shafts.

Geology: Mineralization is along a fault in Mesozoic slates that have been intruded by Tertiary diorite porphyry. Gangue: calcite.

Production: Small

Reference: USGS CRIB Mineral Resources File 12, Record 2722, p. 6926-6928.

76. **Castle Dome Mine**

Location: 33°02'14"N, 114°10'35"W
Sec. 36, T 4S, R 19W, Gila and Salt River Meridian
Commodities: Au, Ag, Pb
Ore Materials: Gold, argentiferous galena
Description of Deposit: Small vein deposit. Workings: 7 shafts.
Geology: Vein is in fault in Mesozoic slate and shale associated with Tertiary diorite porphyry.
Production: One of the major producers of lead in the Castle Dome District.
Reference: USGS CRIB Mineral Resources File 12, Record 2727, p. 6940-6941, and Record 2655, p. 6756 (duplicate files for same property).

77. **Sonora**

Other Name: Haack
Location: 33°01'43"N, 114°10'15"W
Sec. 1, T 5S, R 19W, Gila and Salt River Meridian
Commodities: Ag, Pb, Zn
Major Products: Ag, Pb
Occurrence: Zn
Ore Materials: Argentiferous galena, Pb oxides, anglesite, cerussite, Pb and Zn carbonates, wolframite
Description of Deposit: Small N30°W-trending, 60°E-dipping vein. Workings: 3 shafts.
Geology: Mineralization is along fault in Mesozoic shales which are intruded by Tertiary diorite porphyry dikes. Gangue: barite, fluorite, quartz, and gypsum.
Production: One of the major Pb and Ag producers in the Castle Dome District.
References: USGS CRIB Mineral Resources File 12, Record 2760, p. 7033-7035; Arizona Bureau of Mines Bulletin 180 and 192.

78. **Castle Dome District Record**

Location: 33°02'30"N, 114°10'00"W
T 4S, R 18 W,; T 5S, R 19W; T 4S, R 19W; T 5S, R 18W; Gila and Salt River Meridian
Commodities: Au, Ag, Pb, Ba, F, Be, Sb, Se, V, Mo, Zn
Major Products: Au, Ag, Pb
Minor Products: Ba, F
Occurrences: Be, Sb, Se, V, Mo, Zn
Ore Materials: Gold, argentiferous galena, fluorite, barite, gypsum
Description of Deposit: Small vein deposits. Gold placer deposits are also present.
Geology: Deposits are along faults in Mesozoic shales, slates and limestone in fault contact with Tertiary diorite. Placer deposits are present in Quaternary gravels in streambeds draining the district.
Production: 17,726,930 lbs. of Pb, one ton of F, 459,321 oz.

78. Castle Dome District Record (Continued)

Ag; and an unknown amount of gold were produced from this district.

References: USGS CRIB Mineral Resources File 12, Record 2746, p. 6992-6994; Keith, 1969a; McCrory and O'Haire, 1965, Arizona Bureau of Mines Map; USGS Map MR-46; Allen and Butler, 1921; Wilson and Roseveare, 1949.

79. **Big Eye Mine**

Location: 33°02'33"N, 114°05'58"W
Secs. 27 and 34, T 4S, R 18W, Gila and Salt River Meridian

Commodities: Au, Ag, Cu, Pb, Zn
Major Products: Au, Ag
Minor Products: Cu, Pb
Potential Product: Zn

Ore Materials: Gold, argentiferous galena (?)

Description of Deposit: Lenticular-shaped veins in shear zone. Dimensions: 400 feet long, 4 feet wide. Strikes N25°E and steeply dips westward. Workings: adits and stopes.

Geology: Mineralization is in a brecciated shear zone in Tertiary andesite flows which have been intruded by Tertiary rhyodacite porphyry dikes and faulted against Mesozoic quartzite.

Production: 2,370 tons: 0.90 oz. Au per ton and 8 oz. Ag per ton.

References: USGS CRIB Mineral Resources File 12, Record 2721, p. 6923-6925; Koschmann and Bergendahl, 1968.

80. **Castle Dome Placers**

Location: 33°01'48"N, 114°05'20"W
Secs. 27, 28, 33, 34, and 35, T 4S, R 18W; Gila and Salt River Meridian

Commodity: Au

Ore Material: Gold

Description of Deposit: Small placer deposit. Workings: surface.

Geology: Gold is present in Quaternary alluvium.

Production: $115,000 worth of gold was produced between 1884 and 1944.

References: USGS CRIB Mineral Resources File 12, Record 2723, p. 6929-6931; Johnson, USGS Bulletin 1355; Keith, ABMMT Bulletin 192.

82. **Lincoln Mine**

Other Name: La Colorado

Location: 33°00'16"N, 114°10'07"W
Sec. 12, T 5S, R 19W, Gila and Salt River Meridian

Commodities: Pb, Ag, F, Ba, Cu
Major Product: Pb
Minor Products: Ag, F

82. Lincoln Mine (Continued)
Occurences: Ba, Cu
Ore Materials: Argentiferous galena, fluorite, copper stain present
Description of Deposit: Small vein.
Geology: Mineralization is in shear zone between Mesozic slates, shales, and limestones and intrusive Tertiary diorite porphyry dikes. Calcite and barite are also present.
Production: 1,400 tons of average 43% Pb, 38 oz. Ag per ton, and some F was produced between 1880 and 1949.
References: USGS CRIB Mineral Resources File 12, Record 2761, p. 7036-7038; Keith, 1978, ABMMT Bulletin 192.

96. Plomosa Placers
Location: 33°37'59"N, 114°07'02"W
Secs. 3, 4, 5, 6, 14, 23, 26, and 27, T 3N, R 18W; Secs. 21, 27, 28, 29, 32 and 33, T 4N, R 18W; and Secs. 29, 31, and 32, T 3N, R 17W; Gila and Salt River Meridian.
Commodity: Au
Ore Material: Gold
Description of Deposit: Large placer depost; 4 miles long, 140 feet deep.
Geology: Quaternary stream gravels. Source of gold is veins in Mesozoic schist.
Production: At least $35,000 worth of Au produced prior to 1920.
References: USGS CRIB Mineral Resources File 12, Record 2698, p. 6859-6861; Arizona Bureau of Mines Bulletin 180; Allen, 1922; Koschmann and Bergendahl, USGS, p. 610; Johnson, USGS Bulletin 1355.

98. Iron Queen and Copper Prince
Location: 33°38'03"N, 114°06'01"W
Sec. 3, T 3N, R 18W
Commodities: Au, Ag, Cu
Ore Materials: Unknown
Description of Deposit and Geology:
Mineralization is in quartz veins in Meoszoic schist.
Production: 1,720 tons of ore averaging 0.3 oz. Au per ton, 1 oz. Ag per ton, and 0.6% Cu was mined in the early 1900s.
Reference: Keith, 1978, ABMMT Bulletin 192.

99. Bell of Arizona Mine
Location: 33°38'47"N, 114°04'52"W
Sec. 35, T 4N, R 18W
Commodities: Au, Ag
Ore Materials: Unknown
Description of Deposit and Geology:
Gold and silver are present in a quartz vein in

99. Bell of Arizona Mine (Continued)
fractured Precambrian quartz monzonite. Workings: shallow shafts.
Production: 1937-1941, 1961: 205 tons of ore averaging 0.4 oz. Au per ton and 0.1 oz. Ag per ton.
References: Arizona Bureau of Mines map of base and precious metals; Keith, 1978, ABMMT Bulletin 192.

100. Poorman and Goodman Mines
Location: 33°37'11"N, 114°02'43"W
NE-1/4 Sec. 7, T 3N, R 17W
Commodities: Au, Ag
Ore Materials: Unknown
Description of Deposit and Geology:
Gold-quartz vein in shear zone in Paleozoic sediments. Gangue: quartz, limonite.
Production: About 100 tons of 3.8 oz. Au per ton and 0.8 oz. Ag per ton ore was mined from 1909-1911.
Reference: Keith, 1978, ABMMT Bulletin 192.

101. Renegade Mine
Other Names: Red Hill, Big Chief
Location: 33°31'44"N, 114°02'52"W
NE-1/4 Sec. 7, T 2N, R 17W
Commodities: Au, Ag, Pb, Cu
Major Products: Au, Ag, Pb
Minor Product: Cu
Ore Materials: Unknown
Description of Deposit and Geology:
Mineralization is in a lensing quartz vein along a fault zone in Mesozoic sediments. Workings: underground.
Production: 90 tons of ore averaging 0.6 oz. Au per ton, 0.8 oz. Ag per ton, and 0.4% Pb
Reference: Keith, 1978, ABMMT Bulletin 192.

103. Bright Star Mine
Other Name: Firestone Group
Location: 33°38'39"N, 114°05'53"W
Sec. 34, T 4N, R 18W, Gila and Salt River Meridian
Commodity: W
Ore Material: Scheelite
Description of Deposit and Geology:
Fine-grained, disseminated scheelite is present in quartz veinlets in Mesozic schist.
Production: 17 units WO_3
Reference: Keith, 1978, ABMMT Bulletin 192.

104. Colorado 1-4 Prospect
Other Name: Livingston Property
Location: 33°33'15"N, 114°06'06"W
Sec. 35, T 3N, R 18W, Gila and Salt River Meridian

104. Colorado 1-4 Prospect (Continued)
Commodity: W
Ore Materials: Unknown
Description of Deposit: Small. Workings: surface.
Production: Small
References: USGS CRIB Mineral Resources File 12, Record 2843, p. 7265-7266; Arizona Bureau of Mines Bulletin 180.

105. Nighthawk and White Dike
Other Name: Colorado
Location: 33°33'11"N, 114°05'08"W
Sec. 35, T 3N, R 18W; Gila and Salt River Meridian
Commodities: W, Au, Cu
Ore Material: Scheelite
Description of Deposit: Vein. Workings: surface and underground
Geology: Ore is present in pockets in pegmatic dikes which intrude schist.
Production: Worked from 1942-1944 yielding about 100 units of WO_3. High grade ore.
Reference: USGS CRIB Mineral Resources File 12, Record 2845, p. 7267-7268.
Note: Arizona Bureau of Mines Bulletin lists the Blackhawk, White Dike and Colorado as three different mines.

106. Apache Chief Mine Group
Other Names: Success, Goodenough, Copperopolis, Newmont Group
Location: 33°37'14"N, 114°03'44"W
NE-1/4 Sec. 12, T 3N, R 18W
Commodities: Cu, Ag, Au, Pb, Zn, Fe
Major Products: Cu, Ag, Au
Minor Product: Pb
Occurrences: Zn, Fe
Ore Materials: Unknown
Description of Deposit and Geology:
Supergene-enriched ore in lenses, stringers, and pods, with quartz, along a shear zone in thrust-faulted Paleozoic limestone, Mesozoic red beds and conglomerates near Mesozoic intrusive.
Production: Estimated 2,100 tons of ore averaging 11% Cu, 12 oz. Ag per ton, and 0.03 oz. Au per ton. 700 pounds of Pb also produced.
Reference: Keith, 1978, ABMMT Bulletin 192.

107. Humdinger
Other Names: Picacho, Old Frenchman
Location: 33°37'29"N, 114°04'38"W
Secs. 1, 2, and 11, T 3N, R 18W, Gila and Salt River Meridian
Commodities: Pb, Ag, Au

107. Humdinger (Continued)
Ore Materials: Argentiferous galena, pyrite
Description of Deposit and Geology:
Small quartz vein deposit in shear zone of thrust fault in Mesozoic schist. Workings: surface and underground.
Production: 300 tons of high-grade Pb-Ag ore in the 1860s and 10 tons of ore were produced during WWI.
Reference: USGS CRIB Mineral Resources File 12, Record 2843, p. 7263-7264.

109. Black Mesa Mine
Location: 33°36'02"N, 114°01'56"W
Sec. 17, T 3N, R 17W, Gila and Salt River Meridian
Commodities: Pb, Ag, Cu, Au
Ore Materials: Cerussite, anglesite, galena, chrysocolla, malachite, brochantite, native copper
Description of Deposit: Replacement.
Geology: Deposits replace steeply dipping Paleozoic limestone in a boxwork pattern.
Production: 130 tons ore averaging 3% Cu, 1 oz. Au per ton, and small amount of silver.
Reference: Keith, 1978, ABMMT Bulletin 192.

113. Guadalupe Mine
Other Names: Moreno, Gold Nugget
Location: 33°40'47"N, 114°02'50"W
Sec. 19, T 4N, R 17W; and Sec. 25, T 4N, R 18W; Gila and Salt River Meridian
Commodities: Pb, Au, Ag, Cu, Fe
Major Product: Pb
Minor Products: Au, Ag, Cu
Occurrence: Fe
Ore Materials: Galena, Pb sulfide, cerussite, malachite, anglesite, pyrargyrite, siderite, hematite
Description of Deposit: Small irregularly shaped veins in a N25°W-trending shear zone. Workings: short vertical shaft and surface cuts.
Geology: Mineralization is in a shear zone in granite, schist, Mesozoic gneiss, and Paleozoic quartzite.
Production: 100 tons of 1 oz. Au per ton, 2 oz. Ag per ton, 1% Pb, and 0.1% Cu ore was produced 1935-1951.
References: USGS CRIB Mineral Resources File 12; Keith, 1978, ABMMT Bulletin 192.

115. Ramsey Mine
Other Names: Ramsey and Arizona, R and A Mine
Location: 33°37'44"N, 113°58'41"W
E-1/2 Sec. 2, T 3N, R 17W, Gila and Salt River Meridian
Commodities: Ag, Pb, Zn, Ba, Sr, V, Cu, Mn, Fe, Mo
Major Products: Ag, Pb, Zn
Minor Products: Ba, Sr, V, Cu, Mn, Fe, Mo

115. Ramsey Mine (Continued)
Ore Materials: Unknown
Description of Deposit and Geology:
Two discontinuous, locally high-grade oxidized vein deposits in brecciated zone in Tertiary rhyolite.
Production: 8,400 tons averaging 35 oz. Ag per ton, 1% Pb, 0.5% Zn, 0.1% Cu, and some gold was produced between 1921 and 1969. Patent currently pending.
References: USGS CRIB Mineral Resources File 12, Record 2842, p. 7261-7262; Keith, 1978, ABMMT Bulletin 192; BLM File.

118. Moore Mine Group
Other Names: Eagle Eye, Copper Queen
Location: 33°36'48"N, 113°53'13"W
Secs. 15, 16, 21, and 22, T 3N, R 16W, Gila and Salt River Meridian
Commodities: Cu, Ag, Fe
Ore Materials: Oxidized Cu mineralization, limonite, silver
Description of Deposit and Geology:
Mineralization is in joints, fractures, and small high-grade chimneys in altered porphyryitic andesite of Tertiary age and in fault zones in breccia.
Production: During WWII 480 tons of 3.7% Cu, 1 oz. Ag per ton ore was produced.
Reference: Keith, 1978, ABMMT Bulletin 192.

119. Shamrock Mine
Location: 33°40'30"N, 113°53'28"W
NE-1/4 Sec. 22, T 4N, R 16W
Commodities: Cu, Ag, Au, Mn, Pb
Major Products: Cu, Ag, Au
Occurrences: Mn, Pb
Ore Materials: Unknown
Description of Deposit and Geology:
Vein occupies fault zone in Tertiary andesite.
Production: 210 tons of 6% Cu, 39 oz. Ag per ton, 0.01 oz. Au per ton ore was produced between 1905 and 1918.
Reference: Keith, 1978, ABMMT Bulletin 192.

120. Stafford Mine
Location: 33°39'36"N, 113°53'35"W
Center Sec. 27, T 4N, R 16W
Commodities: Au, Cu, Ag
Ore Materials: Unknown
Description of Deposit and Geology:
Mineralization is in a quartz fissure vein in Tertiary andesite.
Production: 150 tons of ore averaging 0.34 oz. Au per ton and 0.5% Cu was produced between 1908 and 1911.

120. Stafford Mine (Continued)
Reference: Keith, 1978.

121. National Debt Mine
Location: 33°38'54"N, 113°52'45"W
Sec. 35, T 4N, R 16W, Gila and Salt River Meridian
Commodities: Mn, Be
Ore Materials: Pyrolusite, psilomelane
Description of Deposit and Geology:
Lenticular bodies and irregular masses of ore in shear zones in Tertiary andesitic tuffs and agglomerate. Traces of beryllium have been reported.
References: Keith, 1967, ABMMT Bulletin 192; Keith, 1969a.

122. Arizona Silver-Copper Prospect
Location: 33°39'03"N, 113°51'58"W
Secs. 35 and 36, T 4N, R 16W, Gila and Salt River Meridian
Commodities: Ag, Cu
Ore Materials: Unknown
Description of Deposit: Small vein deposit. Workings: underground.
Geology: Unknown
Production: 330 tons of unreported grade were produced prior to 1939.
Reference: USGS CRIB Mineral Resources File 12, Record 2708, p. 6887-6888.

128. Keiser Barite Mine
Other Name: Sierra Blanca
Location: 33°45'22"N, 114°01'53"W
Sec. 21, T 5N, R 17W, Gila and Salt River Meridian
Commodities: Ba, F
Major Product: Ba
Occurrence: F
Ore Materials: Barite, fluorite
Description of Deposit and Geology:
Lenses of barite and fluorite occur along a fault in Tertiary andesitic volcanics.
Production: Two carloads of high-grade barite ore were produced in the 1930s.
Reference: Keith, 1978, ABMMT Bulletin 192.

131. Phoenix and Yuma Groups
Location: 33°48'21"N, 114°04'12"W
NW-1/4 Sec. 6, T 5N, R 17W, Gila and Salt River Meridian
Commodities: Fe
Ore Materials: Hematite
Description of Deposit: Small replacement deposit
Geology: Replacement of Mesozoic limestone.

131. Phoenix and Yuma Groups (Continued)
Production: Small amount.
Reference: USGS CRIB Mineral Resources File 12, Record 2754, p. 7018-7019.

134. Mudersbach Copper Mine

Other Names: Mudersbach Copper Camp, Excelsior Mine
Location: 33°48'16"N, 114°03'53"W
Sec. 6, T 5N, R 17W, Gila and Salt River Meridian
Commodities: Cu, Fe, Ag, Au
Major Product: Cu
Minor Products: Fe, Ag, Au
Ore Materials: Chalcopyrite, bornite, pyrite, hematite, specularite, gold, silver
Description of Deposit: Small replacement deposit.
Geology: Tertiary monzonite porphyry intrudes Mesozoic granites, schists, and limestones. Ore materials replaced intruded limestones.
Production: 700 tons of 4.4% Cu, 0.67 oz. Ag per ton, and 0.03 Au per ton ore was produced between 1900 and 1930.
Reference: USGS CRIB Mineral Resources File 12, Record 2753, p. 7016-7017.
Note: Location is different from CRIB location. Location given is USGS topographic map location of Mudersbach Mine.

136. Lead Camp Mine

Other Names: Southern Cross, Lucky Lead
Location: 33°46'28"N, 114°02'12"W
W-1/2 Sec. 16, T 5N, R 17W, Gila and Salt River Meridian
Commodities: Pb, Ag, Au, Zn, Cu, Fe
Major Products: Pb, Ag
Minor Products: Au, Zn, Cu
Occurrence: Fe
Ore Materials: Silver, galena, cerussite, zinc, gold, copper
Description of Deposit: Small vein deposit. Workings: shaft and cuts.
Geology: Mineralization along fault zone in Mesozoic granites, gneisses and schists. Quartz, iron oxides, chrysocolla, and malachite are present.
Production: At least 1,370 tons, averaging 14% Pb, 4 oz. Ag, per ton, 0.03 oz. Au per ton, and 0.1% Cu.
Reference: USGS CRIB Mineral Resources File 12, Record 2755, p. 7020-7022.
Note: Latitude and longitude corrected from CRIB location. Symbol on USGS topographic map used for location (agrees with USGS CRIB PLS location).

141. Perry Chrysoprase

Location: 33°44'06"N, 114°01'44"W
NE-1/4 Sec. 33, T 5N, R 17W

141. Perry Chrysoprase (Continued)
Commodities: Gem stones
Ore Material: Chrysoprase (green chalcedony)
Description of Deposit and Geology:
Narrow, irregular stringers are present in Tertiary volcanics.
Production: $2,000 worth was sold in the late 1950s.
Reference: Keith, 1978, ABMMT Bulletin 192.

145. Black Beauty Mine
Location: 33°14'14"N, 114°00'27"W
NE-1/4 Sec. 34, T 5N, R 17W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Pyrolusite, psilomelane, manganite
Description of Deposit: Veins in brecciated shear zone.
Geology: Shear zone is in Tertiary andesite flows and tuffs.
Production: 490 long tons of 20% Mn.
Reference: Keith, 1978, ABMMT Bulletin 192.

151. Three Musketeers Mine
Location: 33°50'35"N, 113°46'08"W
SW-1/4 Sec. 24, T 6N, R 15W, Gila and Salt River Meridian
Commodity: W
Ore Material: Scheelite
Description of Deposit: Grains and pods in quartz veins.
Geology: Veins fill fissures in Mesozoic schists and Laramide granitic intrusive.
Production: 1,200 tons of ore yielded 600 units WO_3.
Reference: Keith, 1978, ABMMT Bulletin 192.

152. Yuma Liberator Mine
Other Name: T & A
Location: 33°51'04"N, 113°46'06"W
Sec. 24, T 6N, R 15W, Gila and Salt River Meridian
Commodities: Cu, Ag, Au
Ore Materials: Cu stain, hematite, magnetite
Description of Deposit: Small vein (?). Workings: surface and underground (shafts and shallow cuts). May be replacement.
Geology: Mineralization is in Precambrian metasedimentary rocks intruded by granitic rocks.
Production: 8,600 tons of 2.3% Cu, 0.03% oz. Au per ton, and 0.3 oz. Ag per ton were produced from 1942 to 1963.
Reference: USGS CRIB Mineral Resources File 12, Record 2766, p. 7051-7053.

158. Dona Kay Mine
Location: 33°46'36"N, 113°46'12"W
Sec. 13, T 5N, R 15W, Gila and Salt River Meridian

158. Dona Kay Mine (Continued)
Commodities: Cu, Ag, Au
Ore Materials: Unknown
Description of Deposit and Geology:
Deposit in shear zone in Mesozoic sediments which have been cut by dikes.
Production: 100 tons of ore averaging 0.8% Cu, 0.8 oz. Ag per ton, and 0.03 oz. Au per ton was produced in 1956.
Reference: Keith, 1978, ABMMT Bulletin 192.

160. Sheep Tanks Mine
Other Name: Resolution Group (Sheep Tank Mine on 1:250,000 topographic map)
Location: 33°22'35"N, 113°45'19"W
NE-1/4 NE-1/4 Sec. 1, T 1S, R 15W, Gila and Salt River Meridian
Commodities: Au, Ag, Cu, Pb, Mn, Ba
Major Products: Au, Ag
Minor Product: Cu
Occurrence: Ba
Potential Products: Pb, Mn
Ore Materials: Silver mineral, gold, limonite, pyrolusite, chrysocolla, barite, galena
Description of Deposit: Five small veins (800 x 700 x 40 feet maximum dimensions) strike NW and dip NE. Workings: adits and open cuts.
Geology: Mineralization is along a fault in Tertiary rhyolite and dacite breccia. The breccia has been intruded by diorite porphyry.
Production: $150,000 worth of gold was produced from 1926 to 1933. Present owners and operators estimate presence in the Resolution Hill area of 120,000 tons of ore with a gold-silver value of $12.29 per ton and redevelopment is planned.
References: USGS CRIB Mineral Resources File 12, Record 2662, p. 6765-6768; K.C. DeLise, Manager of Exploration, Sunchief Exploration, Globe, Arizona, written communication to BLM, March 18, 1982.
Note: Location altered from CRIB location to correspond with other information.

162. Hovatter Claim Group
Other Names: Barbie, Bomboy
Location: 33°20'42"N, 113°44'05"W
NE-1/4 Sec. 18, T 1S, R 14W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Pyrolusite, psilomelane
Description of Deposit: Irregularly shaped veins and tabular bodies in shear zone.
Geology: Mineralization is a shear zone in Tertiary andesite flows. Gangue: calcite and brecciated wallrocks.
Production: 250 tons of sorted 18% Mn ore in 1953 and 1954.
References: Keith, 1978, ABMMT Bulletin 192; Keith, 1969a.

165. Davis Prospect

Other Names: Oakland Mine, Verdstone, Bronco, Big Deal, and Oakland Claims

Location: 33°21'17"N, 113°41'19"W
Secs. 3 and 10, T 1S, R 14W, Gila and Salt River Meridian

Commodities: Au, Ag, Fe, Mn, Hg

Ore Materials: Gold, limonite

Description of Deposit: Irregular vein deposit strikes N55°W, dipping 50°N. Worings:inclined shaft.

Geology: Veins in Cretaceous rhyolitic to andesitic flows.

Production: Small. Currently being re-explored.

References: USGS CRIB Mineral Resources File 12, Record 2676, p. 6803-6805; Keith, 1978, ABMMT Bulletin 192; G.W. Morgan, pers. comm. to BLM, 1982, 1981, 1979.

Note: Latitude and longitude given are for workings of the Oakland Mine. The other claims are located to the north. Location is derived from information received by the BLM from the property owners.

167. Golden Harp Mine

Location: 33°05'47"N, 113°37'50"W
W-1/2 Sec. 7, T 4S, R 13W, Gila and Salt River Meridian

Commodities: Au, Cu

Ore Materials: Gold, chrysocolla, Fe oxide

Description of Deposit: N25°E-striking, 80°N-dipping vein is 75 feet long with a maximum width of 2 feet. Workings: 2 vertical shafts and a short open cut.

Geology: Mineralization is in schist intruded by Tertiary diorite porphyry dikes.

Production: Some during the 1930s.

Reference: USGS CRIB Mineral Resources File 12, Record 2717, p. 6912-6914.

168. Tank Mountains Placers

Location: 33°05'35"N, 113°38'06"W
Secs. 7, 8, and 18, T 4S, R 13W, Gila and Salt River Meridian

Commodity: Au

Ore Material: Gold

Description of Deposit and Geology:
Gold is present in shallow bench and stream gravels on the pediment near the lode gold mines of the area.

Production: Some gold was produced in the area.

Reference: Johnson, 1972

169. Ramey Mine

Other Name: Puzzles

Location: 33°06'34"N, 113°36'34"W

169. Ramey Mine (Continued)
Sec. 4, T 4S, R 13W, Gila and Salt River Meridian
Commodity: Au
Ore Material: Gold
Description of Deposit: Small N30°W-striking, 45°NE-dipping vein. Workings: shallow shaft and cuts.
Geology: Mineralization is in schist. Vein is heavily shattered, apparently cut by a post-emplacement fault. Gangue: ferruginous calcite.
Production: Small
Reference: USGS CRIB Mineral Resources File 12, Record 2716, p. 6909-6911.

170. Regal Mine
Location: 33°05'21"N, 113°36'09"W
SE-1/4 Sec. 9, T 4S, R 13W, Gila and Salt River Meridian
Commodity: Au
Ore Material: Gold
Description of Deposit: Small NW-trending lenticular masses dipping 45°SW. Workings: 2 shafts.
Geology: Mineralization is in biotite schist.
Production: Small
Reference: USGS CRIB Mineral Resources File 12, Record 2718, p. 6915-6915.

172. Black Buck and Buckhorn Mine
Location: 33°23'15"N, 113°29'42"W
Sec. 33, T 1N, R 12W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Pyrolusite, psilomelane
Description of Deposit and Geology:
Lenticular bodies of stringers and veins are present in brecciated Mesozoic gneissic granodiorite.
Production: Unknown, but 40 tons of 22% Mn ore were produced in the district in 1953.
References: Keith, 1969a; Keith, 1978, ABMMT Bulletin 192.

175. Black Hawk Mine
Location: 33°21'22"N, 113°28'32"W
NE-1/4 Sec. 10, T 1S, R 12W, Gila and Salt River Meridian
Commodity: Mn
Ore Materials: Pyrolusite, psilomelane
Description of Deposit: Small irregular veins exposed by shallow surface workings.
Geology: Short, flat-dipping manganiferous veins with chalcedony and calcite gangue occur in Tertiary volcanic breccia.
Production: None recorded, but 40 tons of 22% Mn ore were produced in the district in 1953.
References: USGS CRIB Mineral Resources File 12, Record 2674, p. 6798-6799; Keith, 1978, ABMMT Bulletin 192.

188. Bill Taft Mine
Location: 33°15'55"N, 113°21'58"W
Secs. 10, 11, and 15, T 2S, R 11W, Gila and Salt River Meridian
Commodities: Au, Cu
Ore Materials: Gold, hematite, Cu carbonate
Description of Deposit: Vein strikes N80°E and is 200 feet long with a maximum width of 10 feet. Workings: inclined shaft.
Geology: Vein is in schist which is intruded by Tertiary andesite dikes.
Production: Small
Reference: USGS CRIB Mineral Resources File 12, Record 2684, p. 6824-6826.

202. Rowley Mine
Other Names: Reliance, Rawley Mine
Location: 33°02'55"N, 113°02'02"W
Secs. 24, 25, and 36, T 4S, R 8W; and Secs. 30 and 31, T 4S, R 7W; Gila and Salt River Meridian
Commodities: Mo, V, Cu, Pb, Ba
Major Product: Mo
Minor Products: V, Cu, Pb, Ba
Ore Materials: Wulfenite, ferromolybdenite, unknown vanandate, copper and lead minerals, barite
Description of Deposit: Quartz veins.
Geology: Mineralization is in quartz veins cutting Tertiary andesite.
Production: 30 tons of 18% MoO_3 ore
References: USGS CRIB Mineral Resources File 12, Record 781, p. 2115-2116; McCrory and O'Haire, 1965.

220. Copper Camp
Location: 33°16'10"N; 113°17'36"W
Sec. 9, T 2S, R 10W; Maricopa County
Elevation: 488 m: 100 m
Reference: USBM, 1982, MILS
Status: Develop. deposit
Operation Type: Underground
Map Name: Eagle Tail Mountains, 15 min.; Phoenix 2° Quad
Commodities: Copper, iron, ferrous oxide

221. El Cobre Claims
Location: 33°16'10"N; 113°16'49"W
Sec. 10, T 2S, R 10W; Maricopa County
Elevation: 488 m: 100 m
Reference: USBM, 1982, MILS.
Status: Develop. deposit
Operation Type: Surface and underground
Map Name: Eagle Tail Mountains, 15 minl; Phoenix 2° Quad
Commodities: Copper, silver, gold, iron

225. Gold Bud 1-3
Location: 33°03'00"N; 112°43'33"W

225. Gold Bug 1-3 (Continued)
Sec. 25, T 4S, R 5W; Maricopa County; Precision 500 m
Elevation: 341 m: 100 m
Reference: USBM, 1982, MILS.
Status: Develop. deposit
Operation Type: Surface and underground
Map Name: Cotton Center, 7.5 min.; Phoenix 2° Quad
Commodity: Gold

226. Crackerjack No. 2
Location: 33°47'52"N; 113°46'33"W
Sec. unknown, T unknown, R unknown; Yuma County
Elevation: Unknown
Reference: USBM, 1982, MILS.
Status: Past producer
Operation Type: Unknown
Map Name: Phoenix 2° Quad
Commodities: Copper, silver, gold

230. P & J Mine
Location: 33°10'51"N; 112°44'19"W
Sec. 11, T 3S, R 5W; Maricopa County; Precision 500 m
Elevation: 305 m: 500 m
Reference: USBM, 1982, MILS.
Status: Past producer
Operation Type: Surface
Map Name: Cotton Center, 15 min.; Phoenix 2° Quad
Commodities: Silver, gold
Operator: P & J Mining Co.

231. Sundad
Location: 33°10'55"N; 113°13'55"W
Sec. 10, T 2S, R 10W; Maricopa County; Precision 500 m
Elevation: 305 m: 100 m
Reference: USBM, 1982, MILS.
Status: Develop. deposit
Operation Type: Surface and underground
Map Name: Dendora Valley, 15 min.; Phoenix 2° Quad
Commodities: Copper, silver, gold

232. Butte
Location: 33°15'26"N; 112°56'43"W
Sec. 14, T 2S, R 7W; Maricopa County; Precision 500 m
Elevation: 329 m: 100 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Unknown
Map Name: Arlington, 15 min.; Phoenix 2° Quad

232. Butte (Continued)
Commodities: Copper, gold, magnesium, barite, silicon, quartz, olivine-chrysolite, copper oxide, feldspar, clay, fluorine

235. Arrowhead
Location: 33°17'20"N; 112°45'48"W
Sec. 31, T 1S, R 8W; Maricopa County
Elevation: 280 m: 100 m
Reference: USBM, 1982, MILS.
Status: Raw prospect
Operation Type: Surface
Map Name: Buckeye, 15 min.; Phoenix 2° Quad
Commodities: Gemstone, iron, uranium, columbium, mica, semiprecious silicates, hematite, columbite, feldspar, quartz crystal, titanium, magnetite

240. Trigo Mountains Clinoptilite
Location: 33°18'56"N; 114°26'17"W
Sec. 28, T 1S, R 21W; Yuma County; Precision 10 m
Elevation: 420 m: 100 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Unknown
Map Name: Trigo Peaks, 15 min.; Salton Sea 2° Quad
Commodity: Zeolites

242. Silver Star
Location: 33°37'04"N; 113°59'13"W
Sec. 11, T 3N, R 17W; Yuma County; Precision 100 m
Elevation: 549 m: 10 m
Reference: USBM, 1982, MILS.
Status: Past producer
Operation Type: Underground
Map Name: Vicksburg, 15 min.; Phoenix 2° Quad
Commodities: Copper, silver, lead

243. Hardscrabble
Location: 33°06'41"N; 114°35'58"W
Sec. 2, T 4S, R 23W; Yuma County; Precision 1 km
Elevation: 549 m: 10 m
Reference: USBM, 1982, MILS.
Status: Past producer
Operation Type: Underground
Map Name: Picacho, 7.5 min.; Salton Sea 2° Quad
Commodities: Lead, silver, gold, vanadium, molybdenum

247. Climax
Location: 33°46'06"N; 114°03'13"W
Sec. 20, T 5N, R 17W; Yuma County; Precision 100 m

247. Climax (Continued)
Elevation: 512 m: 10 m
Reference: USBM, 1982, MILS.
Status: Past producer
Operation Type: Surface and underground
Map Name: Bouse, 15 min.; Salton Sea 2° Quad
Commodities: Lead, silver, gold

249. Four Peaks
Location: 33°51'50"N; 114°04'48"W
N-1/2 Sec. 13, T 6N, R 18W; Yuma County; Precision 100 m
Elevation: 445 m: 10 m
Reference: USBM, 1982, MILS.
Status: Past producer
Operation Type: Underground
Map Name: Bouse, 15 min.; Salton Sea 2° Quad
Commodities: Copper, gold

250. Desert Queen
Location: 33°37'26"N; 114°06'30"W
NW Sec. 10, T 3N, R 18W; Yuma County; Precision 100 m
Elevation: 530 m: 10 m
Reference: USBM, 1982, MILS.
Status: Past producer
Operation Type: Underground
Map Name: Quartzsite, 15 min.; Salton Sea 2° Quad
Commodities: Copper, silver, gold

Known Prospects, Mineralized Areas, and Geothermal Resources with No Recorded Production

2. Jupiter Prospect
Location: 33°15'55"N, 114°35'00"W
Sec. 1, T 2S, R 23W, Gila and Salt River Meridian
Commodity: Au
Ore Material: Gold
Description of Deposit: Small vein
Geology: Vein is in Mesozoic schist which has been intruded by Tertiary granite porphyry.
Production: Unknown
References: USGS CRIB Mineral Resources File 12, Record 2691, p. 6842-6844.

3. Boardway Prospect
Location: 33°15'40"N, 114°35'03"W
Sec. 12, T 2S, R 23W, Gila and Salt River Meridian
Commodity: Au

3. Boardway Prospect (Continued)
Ore Material: Gold
Description of Deposit: Small east-striking, 15°S-dipping vein. Workings: adit.
Geology: Vein is in schist inclusions in Tertiary granite.
Production: Unknown
Reference: USGS CRIB Mineral Resources File 12, Record 2692, p. 6845-6846.

4-6. Unnamed Gold Occurrences
Location: 4: 33°17'49"N, 114°37'04"W
Sec. 34, T 1S, R 23W, Gila and Salt River Meridian
5: 33°17'40"N, 114°36'01"W
Sec. 35, T 1S, R 23W, Gila and Salt River Meridian
6: 33°18'27"N, 114°34'59"W
Sec. 25, T 1S, R 23W, Gila and Salt River Meridian
Commodity: Au (Au 5 also has silver)
Production: Unknown
Reference: USGS Map MR-46.

8. Unnamed Manganese Occurrence
Location: 33°11'25"N, 114°38'07"W
Sec. 4, T 3S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Production: Unknown
Reference: Keith, 1969a.

15. Unnamed Manganese Occurrence
Location: 33°13'07"N, 114°34'02"W
Sec. 30, T 2S, R 22W, Gila and Salt River Meridian
Commodity: Mn
Production: Unknown
Reference: Keith, 1969a.

19. Unnamed Manganese Occurrence
Location: 33°15'57"N, 114°36'03"W
Sec. 11, T 2S, R 23W, Gila and Salt River Meridian
Commodity: Mn
Production: Unknown
Reference: Keith, 1969a.

20. Unnamed Dumortierite Occurrence
Location: 33°10'37"N, 114°38'08"W
Sec. 9, T 3S, R 23W, Gila and Salt River Meridian
Commodity: Dumortierite, possibly gem quality.
Production: Unknown
References: McCrory and O'Haire, 1965; USGS Map MR-46;

20. Unnamed Dumortierite Occurrence (Continued)
Wilson and Roseveare, 1949, Arizona Bureau of Mines Bulletin 155.

21. Unnamed Chromium and Manganese Occurrence
Location: 33°10'47"N, 114°36'02"W
Sec. 11, T 3S, R 23W, Gila and Salt River Meridian
Commodities: Cr, Mn
Production: Unknown
References: Keith, 1969a; Arizona Bureau of Mines, 1969, Bulletin 180.

23. Unnamed Perlite Occurrence
Location: 33°09'54"N, 114°31'59"W
Sec. 16, T 3S, R 22W, Gila and Salt River Meridian
Commodity: Perlite
Production: Unknown
References: McCrory and O'Haire, 1965; Jaster, 1956, Perlite Resources of the United States: U.S. Geological Survey Bulletin 1027-I.

24. Unnamed Beryllium and Manganese Occurrence
Location: 33°09'03"N, 114°35'02"W
Sec. 24, T 2S, R 23W, Gila and Salt River Meridian
Commodities: Be, Mn
Production: Unknown
Reference: Keith, 1969a.

27. Unnamed Silver and Lead Occurrence
Location: 33°07'52"N, 114°36'02"W
Sec. 26, T 3S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Pb
Production: Unknown
Reference: USGS Map MR-46.

28. Geronimo Prospect
Location: 33°06'58"N, 114°36'46"W
E-1/2 Sec. 34, T 3S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Pb, W, V, Zn, Fe
Major Commodities: Ag, Pb
Minor Commodities: W, V, Zn, Fe
Ore Materials: Silver, Pb oxide, galena, Fe oxide, wulfenite, vanadinite
Description of Deposit: Small N27°W-trending, 65°NE-dipping vein. Workings: 2 shafts, 1 adit.
Geology: Two veins are present in a fault zone in granite.
Production: Unknown
Reference: USGS CRIB Mineral Resources File 12, Record 2701, p. 6868-6870.

30. **Mendevil Prospect**
Other Name: Draper
Location: 33°07'17"N, 114°34'57"W
Sec. 36, T 3S, R 23W; and Sec. 1, T 4S, R 23W; Gila and Salt River Meridian
Commodities: Ag, Pb, Ba, Sr, F
Major Commodities: Ag, Pb
Minor Commodities: Ba, Sr
Occurrence: F
Ore Materials: Pb oxide, barite, cerussite, fluorite
Description of Deposit: Small N10°W-trending vein. Workings: shallow, open cuts.
Geology: Mineralization is along fault separating granite and Tertiary andesite.
Production: Unknown
References: USGS CRIB Mineral Resources, File 12, Record 2703, p. 6874-6876; USGS Map MR-46; Wilson, 1933, Arizona Bureau of Mines Bulletin 134.

37. **Unnamed Silver, Lead, Zinc, and Molybdenum Occurrence**
Location: 33°02'54"N, 114°36'07"W
Sec. 16, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Pb, Zn, Mo
Production: Unknown
Reference: USGS Map MR-46.

38. **Unnamed Silver, Gold, and Copper Occurrence**
Location: 33°02'07"N, 114°35'49"W
Sec. 35, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Au, Cu
Production: Unknown
Reference: USGS Map MR-46.

39. **Unnamed Silver, Gold, and Copper Occurrence**
Location: 33°03'06"N, 114°34'51"W
Sec. 25, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Ag, Au, Cu
Production: Unknown
Reference: USGS Map MR-46.

42. **Riho Prospect**
Location: 33°05'03"N, 114°35'59"W
Sec. 10, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Pb, Zn, V, Ba
Major Commodities: Pb, Zn
Occurrences: V, Ba
Ore Materials: Barite, unreported Pb and Zn minerals
Description of Deposit: Small N35°W-trending, vertically dipping, vein deposit. Workings: pits, open cuts, shafts, stopes, and adits.

42. Riho Prospect (Continued)

Geology:	Vein is in Mesozoic schist cut by Tertiary dikes. Gangue: quartz, calcite, and limonite.
Production:	Unknown
Reference:	USGS CRIB Mineral Resources File 12, Record 2744, P. 6989-6991; U.S.G.S. Map MR-46.

43. Silver Glance Mine

Location:	33°05'31"N, 114°35'34"W Secs. 11 and 12, T 4S, R 23W, Gila and Salt River Meridian
Commodities:	Pb, Zn, Ag, Fe Major Commodity: Pb Minor Commodity: Zn Occurrences: Ag, Fe
Ore Materials:	Galena, Pb oxide, cerussite, anglesite, zinc mineral, wulfenite
Description of Deposit:	Small N15°E-trending, 45°SE-dipping vein deposit. Workings: adit.
Geology:	Mineralization is along fault in Mesozoic quartz-sericite schist. Fault zone is brecciated and slightly offset by several transverse faults.
Production:	Unknown
Reference:	USGS CRIB Mineral Resources File 12, Record 2727, p. 6968-6970.

44. Chloride, Mandarin Prospect

Other Name:	Cash Entry
Location:	33°05'26"N, 114°34'06"W Sec. 7, T 4S, R 23W, Gila and Salt River Meridian
Commodities:	Pb, Ba, Cu, Zn, W, Ag, F, Mn Major Commodities: Pb, Ba Minor Commodities: Cu, Zn, W, Ag, F, Mn
Ore Materials:	Barite, galena, cerussite, Pb oxide, wulfenite, smithsonite, chrysocolla
Description of Deposit:	Small NW-striking, SW-dipping vein. Workings: surface and underground.
Geology:	Mineralization is along faults in granite. Quartz and fluorite are also present.
Production:	Unknown
Reference:	USGS CRIB Mineral Resources File 12, Record 2732, p. 6953-6955.

45. Unnamed Lead and Zinc Occurrence

Location:	33°05'43"N, 114°33'13"W Sec. 8, T 4S, R 22W, Gila and Salt River Meridian
Commodities:	Pb, Zn
Production:	Unknown
Reference:	USGS Map MR-46.

46. Unnamed Barite Occurrence

Location:	33°06'24"N, 114°38'07"W

46. Unnamed Barite Occurrence (Continued)
Sec. 4, T 4S, R 23W, Gila and Salt River Meridian
Commodity: Ba
Production: Unknown
Reference: USGS Map MR-46.

47. Atom Claims 1, 2, and 3
Location: 33°06'12"N, 114°34'57"W
Sec. 1, T 4S, R 23W, Gila and Salt River Meridian
Commodity: U
Description of Deposit: Small vein deposit. Workings: shaft.
Geology: Weakly radioactive zones in hematite-quartz-calcite veins in Precambrian schist intrusions in Precambrian granite. No uranium minerals were recognized.
Production: Unknown
References: USGS CRIB Mineral Resources File 12, Record 2739, p. 6974-6976; USGS Bulletin 1147-A.

48. Unnamed Uranium Occurrence
Location: 33°04'44"N, 114°34'41"W
Sec. 13, T 4S, R 23W, Gila and Salt River Meridian
Commodity: U
Production: Unknown
Reference: Keith, 1969a.

49-50. Unnamed Vanadium Occurrences
Location: 49: 33°04'29"N, 114°37'04"W
Sec. 15, T 4S, R 23W, Gila and Salt River Meridian
50: 33°03"07"N, 114°35'56"W
Sec. 26, T 4S, R 23W, Gila and Salt River Meridian
Commodity: V
Production: Unknown
Reference: USGS Map MR-46.

51. Unnamed Tungsten Occurrence
Location: 33°03'50"N, 114°35'55"W
Sec. 23, T 4S, R 23W, Gila and Salt River Meridian
Commodity: W
Production: Unknown
Reference: USGS Map MR-46.

52. Gold Reef Prospect
Location: 33°03'10"N, 114°34'15"W
Sec. 14, T 4S, R 22W, Gila and Salt River Meridian
Commodities: W, Fe
Ore Materials: Scheelite, hematite, limonite

52. Gold Reef Prospect (Continued)
Description of Deposit: Small vein deposit trends N55W and dips 80°SW. Workings: prospect pits.
Geology: Mineralization is within a fault in Mesozoic quartz-muscovite schist. Schist has been intruded by Tertiary rhyolite and aplite dikes.
Production: Unknown; possible small production in 1953.
References: USGS CRIB Mineral Resources File 12, Record 2733, p. 6956-6958; Wilson, 1941; Keith, 1978, ABMMT Bulletin 192.
Note: Location from map and description in Keith, 1978.

53. Unnamed Chromium Occurrence

Location: 33°05'16"N, 114°33'41"W
Sec. 7, T 4S, R 22W, Gila and Salt River Meridian
Commodity: Cr
Production: Unknown
Reference: USGS Map MR-46.

54. Unnamed Copper, Gold, Lead, and Zinc Occurrence

Location: 33°02'36"N, 114°35'48"W
Sec. 26, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Cu, Au, Zn, Pb
Production: Unknown
Reference: USGS Map MR-46.

56. Unnamed Iron Occurrence

Location: 33°20'22"N, 114°31'50"W
Sec. 16, T 1S, R 22W, Gila and Salt River Meridian
Commodity: Fe
Production: Unknown
Reference: Keith, 1969a.
Note: Location given is an estimate.

57-58. Unnamed Gold Occurrences

Location: 57: 33°17'34"N, 114°29'48"W
Sec. 35, T 1S, R 22W, Gila and Salt River Meridian
58: 33°17'33"N, 114°27'58"W
Sec. 31, T 1S, R 21W, Gila and Salt River Meridian
Commodity: Au
Production: Unknown
Reference: USGS Map MR-46.

59. Unnamed Manganese Occurrence

Location: 33°15'07"N, 114°15'00"W
Sec. 14, T 2S, R 22W, Gila and Salt River Meridian
Commodity: Mn
Production: Unknown
Reference: Keith, 1969a.

61. Unnamed Mineral Occurrence
Location: 33°09'50"N, 114°19'50"W
Sec. 16, T 3S, R 20W, Gila and Salt River Meridian
Commodities: Unknown
Production: Unknown
Reference: USGS Map MR-46.

62. Tweed Mine
Location: 33°17'15"N, 114°17'57"W
Sec. 35, T 1S, R 20W, Gila and Salt River Meridian
Commodities: Unknown
Production: Unknown
Reference: USGS Map MR-46.

63. Thermal Well
Location: 33°15'55"N, 114°14'32"W
Sec. 8, T 2S, R 19W, Gila and Salt River Meridian
Production: None
Reference: Witcher et al., 1982.
Note: Water termperature is 44° C.

64. Unnamed Uranium Occurrence
Location: 33°02'14"N, 114°17'10"W
Secs. 35 and 36, T 4S, R 20W, Gila and Salt River Meridian
Commodity: U
Production: Unknown
Reference: Keith, 1969a.

72. Big Dome Prospect
Location: 33°01'55"N, 114°10'07"W
Sec. 36, T 4S, R 19W, Gila and Salt River Meridian
Commodities: Pb, Zn, F
Major Commodities: Pb, Zn
Occurrence: F
Ore Materials: Galena, unreported Zn mineral, fluorite
Description of Deposit: Small N25°W-trending, 70°W-dipping vein. Four shafts develop the prospect.
Geology: Vein is in a fault zone in Mesozoic shales which have been intruded by Tertiary diorite porphyry.
Production: Unknown
References: USGS CRIB Mineral Resources File 12, Record 2731, p. 6950-6952; USGS CRIB Mineral Resources File 12, Record 2647, p. 6746-6748 (duplicate records of same deposit).

81. Unnamed Manganese Occurrence
Location: 33°01'54"N, 114°07'16"W
Sec. 33, T 4S, R 18W, Gila and Salt River Meridian

81. Unnamed Manganese Occurrence (Continued)
Commodity: Mn
Production: Unknown
Reference: USGS Map MR-46.

83. Unnamed Lead and Tungsten Occurrence
Location: 33°03'34"N, 114°34'59"W
Sec. 24, T 4S, R 23W, Gila and Salt River Meridian
Commodities: Pb, W
Production: Unknown
Reference: USGS Map MR-46.

84. Tunnel Springs Prospect
Location: 33°23'30"N, 114°03'06"W
Secs. 30 and 31, T 1N, R 17W, Gila and Salt River Meridian
Commodity: Au
Ore Material: Gold
Description of Deposit: Small vein. Workings: adits, shafts, and shallow open cuts.
Geology: Vein is in Tertiary tuff and andesite which is cut by Tertiary andesite porphyry dikes.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2671, p. 6790-6792.

85. Unnamed Gold Occurrence
Location: 33°23'54"N, 114°03'15"W
Sec. 6, T 1S, R 17W, Gila and Salt River Meridian
Commodity: Au
Production: Unknown
Reference: USGS Map MR-46.

86. Mineral Occurrence
Location: 33°23'55"N, 114°04'06"W
Sec. 25, T 1N, R 18W, Gila and Salt River Meridian
Commodities: Unknown
Production: Unknown
Reference: USGS Salton Sea 1:250,000 topographic map.
Note: Location is symbol on USGS Salton Sea 1:250,000 topographic map.

87. Rand Prospect
Location: 33°24'03"N, 113°58'41"W
E-1/2 Sec. 26, T 1N, R 17W, Gila and Salt River Meridian
Commodity: Au
Ore Material: Gold
Description of Deposit: Quartz vein. Workings: shallow shaft.
Geology: Vein is in Tertiary andesite porphyry.
Production: None

87. Rand Prospect (Continued)

Reference:	USGS CRIB Mineral Resources File 12, Record 2670, p. 6788-6789.

88. Geyser Prospect

Other Name:	Silent King
Location:	33°24'02"N, 113°58'24"W W-1/2 Sec. 25, T 1N, R 17W, Gila and Salt River Meridian
Commodity:	Au
Ore Material:	Gold
Description of Deposit:	Stringers and veinlets in vein 1.5 miles maximum length, 140 feet maximum depth. Vein strikes N80°W and dips 45°S. Workings: inclined shaft.
Geology:	Vein is in Tertiary andesite porphyry.
Production:	Unknown
Reference:	USGS CRIB Mineral Resources File 12, Record 2669, p. 6787-6787.

89. I.X.L. Prospect

Location:	33°24'03"N, 113°57'45"W Center Sec. 25, T 1N, R 17W, Gila and Salt River Meridian
Commodity:	Au
Ore Material:	Gold
Description of Deposit:	Small lenticular vein. Workings: inclined shaft.
Geology:	Mineralization is in Tertiary andesite porphyry.
Production:	Unknown
Reference:	USGS CRIB Mineral Resources File 13, Record 2668 p. 6783-6784.

90. C.O.D. Prospect

Location:	33°23'28"N, 113°57'29"W NE-1/4 Sec. 36, T 1N, R 17W, Gila and Salt River Meridian
Commodity:	Au
Ore Material:	Gold
Description of Deposit:	Small Vein. Workings: shaft and cuts.
Geology:	Vein is in a 10 to 40 feet wide brecciated zone in Tertiary andesite porphyry.
Production:	Unknown
Reference:	USGS CRIB Mineral Resources File 13, Record 2672, p. 6793-6794.

91. Regal Group Prospect

Location:	33°22'47"N, 113°56'06"W SW-1/4 Sec. 32, T 1N, R 16W, Gila and Salt River Meridian
Commodity:	Au
Ore Material:	Gold
Description of Deposit:	Stringers in small vein (maximum 6 foot width) trending N80°W and dipping

91. Regal Group Prospect (Continued)

45°S. Workings: shallow shafts, adits.

Geology: Vein is in Tertiary andesite porphyry.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2667, p. 6780-6782.

92. Alamo Prospect

Location: 33°26'03"N, 113°54'15"W
NE-1/4 Sec. 16, T 1N, R 16W, Gila and Salt River Meridian
Commodity: Cu
Ore Materials: Chrysocolla, malachite, Cu oxides
Description of Deposit: Small irregularly shaped veins.
Geology: Mineralization is in granite that has been intruded by Tertiary andesite dikes.
Production: None
Reference: USGS CRIB Mineral Resources File 13, Record 2666, p. 6778-6779.

93. Alonah Prospect

Location: 33°25'03"N, 113°52'43"W
N-1/2 Sec. 23, T 1N, R 16W, Gila and Salt River Meridian
Commodities: Cu, Fe
Major Commodity: Cu
Occurrence: Fe
Ore Materials: Oxidized Cu, magnetite
Description of Deposit: Small irregularly shaped replacement. Workings: shallow open cuts.
Geology: Ore is along a shear zone in granite, in small seams and replacing granite in the shear zone. Tertiary andesite porphyry has intruded the granite.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2665, p. 6775-6777.

94. Big Horn Prospect

Location: 33°25'51"N, 113°51'30"W
N-1/2 Sec. 13, T 1N, R 16W, Gila and Salt River Meridian
Commodities: Au, Fe, Mn
Major Commodity: Au
Occurrences: Fe, Mn
Ore Materials: Gold, Fe and Mn oxides
Description of Deposit: Small vein deposit. Workings: adit and shaft.
Geology: Ore occurs in a shear zone several feet wide in Tertiary andesite porphyry.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2664, p. 6772-6774.

95. Cemitosa Prospect

Location: 33°25'38"N, 113°51'20"W

95. Cemitosa Prospect (Continued)
E-1/2 Sec. 13, T 1N, R 16W, Gila and Salt River Meridian
Commodities: Au, Fe, Mn
Major Commodity: Au
Occurrences: Fe, Mn
Ore Materials: Iron stains, manganese
Description of Deposit: Vein is 1,500 feet long with a maximum width of 10 feet and strikes N50°W, vertical dip. Workings: small discovery hole.
Geology: Vein is in Tertiary andesite porphyry.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2663, p. 6769-6771.

97. New York-Plomosa Prospect
Location: 33°38'23"N, 114°07'50"W
Sec. 32, T 4N, R 18W, Gila and Salt River baseline
Commodity: Au
Ore Material: Gold
Description of Deposit: Placer. Workings: underground (shafts and one adit).
Geology: Gold is present in Quaternary conglomerate with granite, schist, and quartz fragments cemented by caliche.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2710,. p. 6892-6893.

102. Jac O Lou Mine
Location: 33°38'05"N, 114°06'43"W
NW-1/4 Sec. 3, T 3N, R 18W
Commodities: Unknown. Located in Plomosa placer mines area.
Production: Unknown
Reference: Symbol on Salton Sea 1:250,000 topographic map.

104. Colorado 1-4 Prospect
Location: 33°33'15"N, 114°06'43"W
Sec. 35, T 3N, R 18W, Gila and Salt River Meridian
Commodity: W
Description of Deposit: Small. Workings: surface.
Production: Small
References: USGS CRIB Mineral Resources File 12, Record 2844, p. 7265-7266; Arizona Bureau of Mines Bulletin 180.

108. Unnamed Lead Occurrence
Location: 33°39'30"N, 114°02'01"W
Sec. 29, T 4N, R 17W, Gila and Salt River Meridian
Commodity: Pb

108. Unnamed Lead Occurrence (Continued)
Production: Unknown
Reference: USGS Map MR-46.

110. Unnamed Copper, Gold, and Silver Deposit
Location: 33°32'27"N, 114°05'27"W
NE-1/4 Sec. 2, T 2N, R 18W, Gila and Salt River Meridian
Commodities: Cu, Au, Ag
Production: Unknown
Reference: Keith, 1969b.
Note: Location derived from map. No information beyond location and commodities is available.

111-12. Unnamed Iron Occurrences
Location: 111: 33°35'48"N, 114°03'27"W
Sec. 18, T 3N, R 17W, Gila and Salt River Meridian
112: 33°35'50"N, 114°02'48"W
Sec. 18, T 3N, R 17W, Gila and Salt River Meridian
Commodity: Fe
Production: Unknown
Reference: Keith, 1969a.

114. Unnamed Marble or Onyx Occurrence
Location: 33°40'21"N, 114°05'07"W
Sec. 23, T 4N, R 18W, Gila and Salt River Meridian
Commodities: Building or ornamental stone.

116. Unnamed Manganese Occurrence
Location: Sec. 11, T 3N, R 17W, Gila and Salt River Meridian
Commodity: Mn
Production: Unknown
Reference: Keith, 1969a.

117. Republic Mine
Location: 33°37'55"N, 113°55'55"W
Sec. 5, T 3N, R 16W
Commodities: Unknown
Production: Unknown
Reference: Symbol on USGS 1:250,000 Salton Sea topographic map.

123. Rayvern Group
Location: 33°51'24"N, 114°06'12"W
Sec. 14, T 6N, R 18W, Gila and Salt River Meridian
Commodities: U, Fe, Mn
Ore Materials: Carnotite, urophane, meta-autinite
Description of Deposit and Geology:
Manganese occurs in red beds. Carnotite is

123. Rayvern Group (Continued)
present in fractures, and uraniferous silica occurs in chert. Minor bedding plane fault controls mineralization.
Production: None
References: Keith, 1969a; Walker and Osterwald, 1963; Scarborough and Wilt, 1979; Chew and Antrim, 1982.

124. Lillian # 1, 2, and 3
Location: 33°53'33"N, 114°04'47"W
NE-1/4 Sec. 1, T 6N, R 18W
Commodities: U, Cu, Ba, Mn, Au, Ag
Production: Unknown
Reference: Scarborough and Wilt, 1979.

125-27. Unnamed Barite Occurrences
Location: 125: 33°48'58"N, 114°04'05"W
Sec. 31, T 6N, R 17W, Gila and Salt River Meridian
126: 33°48'54"N, 114°03'11"W
Sec. 32, T 6N, R 17W, Gila and Salt River Meridian
127: 33°44'40"N, 114°03'58"W
Sec. 30, T 5N, R 17W, Gila and Salt River Meridian
Commodity: Ba
Ore Materials: Barite
Production: Unknown
Reference: McCrory and O'Haire, 1965.

129. Unnamed Iron Occurrence
Location: Sec. 31, T 6N, R 17W, Gila and Salt River Meridian
Commodity: Fe
Production: Unknown
Reference: Keith, 1969a.

130,132. Unnamed Iron Occurrences
Location: 130: 33°49'14"N, 114°04'05"W
Sec. 31, T 6N, R 17W, Gila and Salt River Meridian
132: 33°47'48"N, 114°03'40"W
Sec. 6, T 5N, R 17W, Gila and Salt River Meridian
Commodity: Fe
Production: Unknown
Reference: Keith, 1969a.

133. Unnamed Barite Occurrence
Location: 33°53'24"N, 114°04'04"W
Sec. 6, T 6N, R 17W, Gila and Salt River Meridian
Commodity: Ba
Ore Material: Barite

133. Unnamed Barite Occurrence (Continued)
Production: Unknown
Reference: McCrory and O'Haire, 1965.

135. Unnamed Copper, Gold, and Silver Occurrence
Location: 33°49'05"N, 114°03'20"W
NE-1/4 Sec. 32, T 6N, R 17W, Gila and Salt River Meridian
Commodities: Cu, Au, Ag
Production: Unknown
Reference: Keith, 1969a.

137. Unnamed Lead Occurrences
Location: 33°51'40"N, 114°01'02"W
Sec. 15, T 6N, R 17W, Gila and Salt River Meridian
Commodity: Pb
Production: Unknown
Reference: USGS Map MR-46.

138. Unnamed Beryllium Occurrence
Location: 33°50'39"N, 114°02'09"W
Sec. 21, T 6N, R 17W, Gila and Salt River Meridian
Commodity: Be
Production: Unknown
Reference: Keith, 1969a.

139. Unnamed Gypsum Occurrence
Location: 33°50'36"N, 113°59'55"W
Sec. 23, T 6N, R 17W, Gila and Salt River Meridian
Commodities: Construction materials
Ore Material: Gypsum
Production: Unknown
Reference: McCrory and O'Haire, 1965.

140. Plomosa
Location: 33°45'00"N, 114°02'00"W
T 5N, R 17W, Gila and Salt River Meridian
Commodity: Au
Description of Deposit: Siliceous base-metal vein.
Production: Unknown; district produced less than 10,000 oz. Au.
Reference: USGS CRIB Mineral Resources File 12, Record 2650, p. 6751; Arizona Bureau of Mines Bulletin 180.

142. Unnamed Manganese and Iron Occurrence
Location: 33°48'43"N, 114°04'02"W
Sec. 31, T 6N, R 17W, Gila and Salt River Meridian
Commodities: Mn, Fe
Production: Unknown
Reference: Keith, 1969a

143-44, 146-47. Unnamed Manganese Occurrences

Location: 143: 33°48'51"N, 114°00'58"W
Sec. 34, T 6N, R 17W, Gila and Salt River Meridian
144: 33°43'37"N, 114°02'24"W
Sec. 33, T 5N, R 17W, Gila and Salt River Meridian
146: 33°49'53"N, 113°59'01"W
Sec. 25, T 6N, R 17W, Gila and Salt River Meridian
147: 33°49'03"N, 113°58'02"W
Sec. 31, T 6N, R 16W, Gila and Salt River Meridian
148: 33°50'39"N, 113°56'49"W
Sec. 20, T 6N, R 16W, Gila and Salt River Meridian
Commodity: Mn
Production: Unknown
References: 143: Keith, 1969a; 144-147: USGS Map MR-46.

149. McVay Mining Co.

Other Name: Pee Wee Mine Group
Location: 33°50'35"N, 113°46'45"W
Secs. 23, 24, 25, and 26, T 6N, R 15W, Gila and Salt River Meridian
Commodity: W
Ore Material: Scheelite
Description of Deposit: Small deposit. Surface mining.
Geology: Deposit is in granite, limestone and schist.
Production: None
References: USGS CRIB Mineral Resources File 12, Record 2853, p. 7283-7284; Keith, 1978, ABMMT Bulletin 192.
Note: Latitude given is corrected from the one given by USGS CRIB file in order to correspond to other data. Location of map symbol corresponds to the latitude and longitude given above and matches the location given in ABMMT Bulletin 192.

150. Berdie-Lee Claims

Location: 33°50'33"N, 113°46'42"W
Secs. 24 and 25, T 6N, R 15W, Gila and Salt River Meridian
Commodity: W
Description of Deposit: Small deposit in shear zone. Workings: surface and underground.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2767, p. 7054-7055.

153. Unnamed Manganese Occurrence

Location: Sec. 25, T 6N, R 15W, Gila and Salt River Meridian
Commodity: Mn

153. Unnamed Manganese Occurrence (Continued)
Production: Unknown
Reference: USGS Map MR-46.

154. Unnamed Lead Occurrences
Location: 33°48'04"N, 113°47'24"W
Sec. 2, T 5N, R 15W, Gila and Salt River Meridian
Commodity: Pb
Production: Unknown
Reference: USGS Map MR-46.

155. Area of Low-Termperature Geothermal Waters
Location: T 5N, R 16W and R 15W; T 4N, R 16W and R 15W; T 3N, R 16W and 15W; T 2N, R 15W; Ranegras Plain, Gila and Salt River Meridian
Reference: Witcher et al., 1982.
Note: Area is favorable for the discovery and development of low-temperature (<100°C) geothermal resources.

156. Unnamed Copper, Gold, and Lead Occurrence
Location: 33°39'38"N, 114°03'56"W
Sec. 25, T 4N, R 18W, Gila and Salt River Meridian
Commodities: Cu, Au, Pb
Production: Unknown
Reference: Keith, 1969a.

157. Unnamed Silver and Gold Occurrence
Location: 33°37'42"N, 114°02'12"W
Sec. 5, T 3N, R 17W, Gila and Salt River Meridian
Commodities: Ag, Au
Production: Unknown
Reference: USGS Map MR-46.

159. Mineral Occurrence
Location: 33°45'45"N, 114°03'27"W
NE-1/4 Sec. 19, T 5N, R 17W, Gila and Salt River Meridian
Commodities: Unknown
Production: Unknown
Reference: Symbol on Salton Sea 1:250,000 topographic map.

161. Unnamed Manganese and Beryllium Occurrence
Location: 33°22'03"N, 113°44'55"W
Sec. 6, T 1S, R 17W, Gila and Salt River Meridian
Commodities: Mn, Be
Production: Unknown
Reference: Keith, 1969a.

163. Unnamed Manganese Occurrence
Location: 33°19'02"N, 113°43'53"W

163. Unnamed Manganese Occurrence (Continued)
NW-1/4 Sec. 29, T 1S, R 14W, Gila and Salt River Meridian
Commodity: Mn
Production: Unknown
Reference: Keith, 1969a.

164. Allison Prospect
Location: 33°21'16"N, 113°42'10"W
SE-1/4 Sec. 9, T 1S, R 14W, Gila and Salt River Meridian
Commodity: Au
Ore Material: Gold
Description of Deposit: Small E-trending, lenticular ore bodies were worked at surface and in old shaft.
Geology: Mineralization is in Tertiary rhyolite to andesitic flows near a Tertiary diorite porphyry intrusive.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2677, p. 6806-6807.

166. Unnamed Lead Occurrence
Location: 33°19'34"N, 113°39'10"W
Sec. 24, T 1S, R 14W, Gila and Salt River Meridian
Commodity: Pb
Production: Unknown
Reference: USGS Map MR-46.

171,176,177. Unnamed Manganese Occurrences
Location: 171: 33°22'12"N, 113°31'50"W
Sec. 6, T 1S, R 12W, Gila and Salt River Meridian
176: 33°22'06"N, 113°27'52"W
Sec. 2, T 1S, R 12W, Gila and Salt River Meridian
177: 33°22'51"N, 113°25'42"W
Sec. 31, T 1N, R 11W, Gila and Salt River Meridian
Commodity: Mn
Production: Unknown
Reference: USGS Map MR-46.

173. Unnamed Tremolite or Actinolite Occurrence
Location: 33°24'01"N, 113°28'55"W
Sec. 27, T 1N, R 12W, Gila and Salt River Meridian
Commodities: Tremolite or actinolite (asbestiform)
Production: None
Reference: McCrory and O'Haire, 1965.

174. Adams Prospect
Location: 33°23'08"N, 113°29'21"W
Sec. 34, T 1N, R 12W, Gila and Salt River Meridian

174. Adams Prospect (Continued)
Commodity: Au
Ore Material: Gold
Description of Deposit: Small NW-striking vein. Workings: shaft.
Geology: Mineralization is associated with a Tertiary granite porphyry dike.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2661, p. 6762-6764.

178. Red Bird Prospect
Location: 33°21'28"N, 113°26'13"W
E-1/2 Sec. 12, T 1S, R 12W, Gila and Salt River Meridian
Commodity: Au
Ore Material: Gold
Description of Deposit: Small N60°W-trending, 45°W-dipping veinlets. Workings: 1 shaft.
Geology: Veinlets are along a fault that separates granite containing schist masses and Tertiary rhyolite porphyry.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2675, p. 6800-6802.

179. Collins Prospect
Location: 33°19'07"N, 113°25'26"W
NE-1/2 Sec. 30, T 1S, R 11W, Gila and Salt River Meridian
Commodities: Cu, Au, Ag
Ore Materials: Chalcopyrite, malachite
Description of Deposit: Small vein deposit. Workings: 2 shallow shafts and a few shallow surface cuts.
Geology: Mineralization is localized along fractures and minor faults in schist that has been intruded by Tertiary rhyolite porphyry. Gangue: iron and manganese oxides and quartz.
Production: None
References: USGS CRIB Mineral Resources File 12, Record 2673, p. 6795-6797; Keith, 1978.

180. Unnamed Zinc, Copper, and Gold Occurrence
Location: 33°30'22"N, 113°25'19"W
Sec. 19, T 2N, R 11W, Gila and Salt River Meridian
Commodities: Zn, Cu, Au
Production: Unknown
References: USGS Map MR-46.

181. Eagle Tail Group
Other Name: Golden State Mine
Location: 33°29'14"N, 113°24'51"W
NW-1/4 Sec. 28, T 2N, R 11W, Gila and Salt River Meridian

181. Eagle Tail Group (Continued)
Commodities: Cu, Pb, Zn, Ag, Au
Description of Deposit and Geology:
Veins, veinlets, and pods in shear zone cutting Tertiary volcanics and plutonic rock. Gangue: quartz, calcite, and barite.
Production: Unknown
References: ABMMT Bulletin 192.

182. Gentry Lead-Silver Mine
Location: 33°27'30"N, 113°21'36"W
Center N-1/2 Sec. 2, T 1N, R 11W, Gila and Salt River Meridian
Commodities: Pb, Ag, Zn, Cu
Description of Deposit and Geology:
Veins, veinlets, and pods along shear zone in Tertiary volcanics. Gangue: quartz, calcite and barite.
Production: Unknown
Reference: Keith, 1978, ABMMT Bulletin 192.

183. Unnamed Uranium Occurrence
Location: 33°12'50"N, 113°25'14"W
Sec. 31, T 2S, R 11W, Gila and Salt River Meridian
Commodity: U

184. Unnamed Fluorite Occurrence
Location: 33°14'25"N, 113°22'45"W
Sec. 22, T 2S, R 11W, Gila and Salt River Meridian
Commodity: F
Ore Material: Fluorite
Production: Unknown
Reference: McCrory and O'Haire, 1965.

185. Belle MacKeever Prospect
Location: 33°15'10"N, 113°23'08"W
Sec. 16, T 2S, R 11W, Gila and Salt River Meridian
Commodity: Au
Ore Materials: Gold, iron oxide
Description of Deposit: Small NE-trending, 50°N-dipping lenses. Workings: a few shallow cuts.
Geology: Gold is in quartz lenses in schist which has been intruded by a Tertiary andesite dike.
Production: Unknown
Reference: USGS CRIB Mineral Resources File 12, Record 2686, p. 6829-6830.

186. Yellow Breast Prospect
Location: 33°15'13"N, 113°22'45"W
W-1/2 Sec. 15, T 2S, R 11W, Gila and Salt River Meridian
Commodity: Pb

186. Yellow Breast Prospect (Continued)
Ore Materials: Galena, anglesite, cerussite, wulfenite, Pb oxide
Description of Deposit: Small irregularly shaped deposits. Workings: 2 vertical shafts.
Geology: Brecciated ore-bearing quartz vein occurs along a fault zone parallel to the foliation of schist which is intruded by Tertiary andesitic to granitic dikes.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2685, p. 6827-6828.

187. Unnamed Molybdenum Occurrence
Location: 33°15'28"N, 113°22'30"W
Sec. 15, T 2S, R 11W, Gila and Salt River Meridian
Commodity: Mo
Production: Unknown
Reference: Keith, 1969a.

189. Black Silver, Stardust, Outlaw, Big "M", and GeoAnn Claims
Location: 33°16'40"N; 113°20'20"W
Secx. 1, 2, 10, 11, 12, 14, 15, and 16, T 2S, R 11W; and Secs. 5, 6, and 8, T 2S, R 10W
Commodities: Au, Cu, Ag, Pb, Zn
Ore Materials: Unreported
Geology: Unreported. Locations plot in Precambrian schists and granites.
Production: None. Area is currently being explored.
Reference: G.W. Morgan (BLM file).

190. Camp Creek Prospect
Location: 33°17'04"N, 113°20'52"W
Sec. 1, T 2S, R 11W, Gila and Salt River Meridian
Commodities: Au, Cu, Fe
Major Commodities: Au, Cu
Ore Materials: Hematite, gold, chrysocolla, limonite, malachite
Description of Deposit: Small irregular, E-trending, steeply dipping ore body.
Geology: Mineralization is in schist that is cut by Tertiary granite porphyry dikes.
Production: None
Reference: USGS CRIB Mineral Resources File 12, Record 2683, p. 6822-6823.

191. Unnamed Copper Deposit
Location: 33°08'23"N, 113°23'45"W
Sec. 28, T 3S, R 11W, Gila and Salt River Meridian
Commodity: Cu
Production: Unknown
Reference: USGS Map MR-46.

192. Agua Caliente/Hyder Area of Low-Temperature Geothermal Waters
Location: T 3S, R 12W, R 11W and R 10W; T 4S, R 12W, R 11W and R 10W; Gila and Salt River Meridian
Reference: Witcher et al., 1982.
Note: Hot springs at Agua Caliente, just south of the map area, were used as a health resort but are now dry. Thirteen irrigation wells shown on the map have water temperatures ranging from 35°C to 49°C.

193. Area of Low-Temperature Geothermal Waters
Location: T 3N, R 14W and R 13W; T 2N, R 14W and 13W; Gila and Salt River Meridian
Reference: Witcher et al., 1982.
Note: This area is the southern extension of Gt 125, Ranegras Plain.

194. Agua Caliente/Hyder Area of Low-Temperature Geothermal Waters
Location: T 3S, R 10W; T 4S, R 10W; T 5S, R 10W; Gila and Salt River Meridian
Reference: Witcher et al., 1982.
Note: This is the southeastward extension of the area listed as Gt 192. Three thermal wells are located in this part of the area; temperatures are 35°C to

195-96. Unnamed Mineral Occurrences
Location: 195: 33°13'01"N, 113°12'14"W; Unsurveyed
196: 33°12'39"N, 113°10'56"W; Unsurveyed
Commodities: Unknown
Production: Unknown
References: U.S.G.S. Map MR-46.

197-98. Unnamed Lead Occurrences
Location: 197: 33°13'25"N, 113°10'52"W; Unsurveyed
198: 33°14'06"N, 113°11'07"W; Unsurveyed
Commodity: Pb
Production: Unknown
Reference: USGS Map MR-46.

199. Unnamed Copper Occurrence
Location: 33°01'26"N, 113°10'34"W
Sec. 3, T 5S, R 9W, Gila and Salt River Meridian
Commodity: Cu
Production: Unknown
Reference: USGS Map MR-46.

200. Area of Low-Temperature Geothermal Waters
Location: T 1S, R 9W, R 8W, R 7W and R 6W; Gila and Salt River Meridian
Reference: Witcher et al., 1982.
Note: Area has 2 thermal wells with temperatures of 41°C and 45°C and is considered potentially favorable for the discovery and development of low-temperature (<100°C) geothermal resources.

201. Unnamed Mineral Occurrence
Location: 33°02'25"N, 113°02'34"W
Sec. 36, T 4S, R 8W, Gila and Salt River Meridian
Commodities: Unknown
Production: Unknown
Reference: USGS Map MR-46.

203. Unnamed Mineral Occurrence
Location: 33°03'54"N, 113°02'11"W
Sec. 24, T 4S, R 8W, Gila and Salt River Meridian
Commodities: Unknown
Production: Unknown
Reference: USGS Map MR-46.

204. Unnamed Lead Occurrence
Location: 33°03'18"N, 112°58'54"W
Sec. 28, T 4S, R 7W, Gila and Salt River Meridian
Commodity: Pb
Production: Unknown
Reference: USGS Map MR-46.

205. Unnamed Tuff Location
Location: 33°17'46"N; 112°56'42"W
Sec. 35, T 1S, R 7W, Gila and Salt River Meridian
Commodity: Building stone
Ore Material: Tuff
Production: Unknown
Reference: McCrory and O'Haire, 1965.

206. Idazona Mine
Location: 33°14'50"N; 112°56'42"W
Sec. 19, T 2S, R 6W, Gila and Salt River Meridian
Commodity: Cu
Production: Unknown
Reference: Arizona Bureau of Mines Bulletin 180.
Note: Location is approximate

207. Buckeye Copper Mine
Location: 33°13'34"N, 112°52'21"W
Center E-1/2 Sec. 28, T 2S, R 6W, Gila and Salt River Meridian
Commodity: Cu
Production: Unknown
Reference: USGS CRIB Mineral Resources File 12, Record 759, p. 2072-2073.

208. Harcan Mine
Location: 33°13'37"N, 112°52'47"W
Sec. 28, T 2S, R 6W, Gila and Salt River Meridian

208. Harcan Mine (Continued)
Commodities: Unknown
Production: Unknown
Reference: Symbol on USGS Phoenix 1:250,000 topographic map.

209. Unnamed Bismuth Occurrence
Location: 33°12'44"N, 112°52'27"W
Sec. 33, T 2S, R 6W, Gila and Salt River Meridian
Commodity: Bi
Production: Unknown
Reference: Keith, 1969a.

210. Unnamed Barite Occurrence
Location: 33°15'21"N, 112°51'55"W
Sec. 15, T 2S, R 6W, Gila and Salt River Meridian
Commodity: Ba
Ore Material: Barite
Production: Unknown
Reference: McCrory and O'Haire, 1965.

211. Unnamed Perlite Occurrence
Location: 33°21'20"N, 112°44'18"W
Sec. 11, T 1S, R 5W, Gila and Salt River Meridian
Commodity: Perlite
Production: Unknown
Reference: McCrory and O'Haire, 1965.

212. Buckeye Euxenite Occurrence
Location: 33°18'24"N, 112°39'58"W
Sec. 28, T 1S, R 4W, Gila and Salt River Meridian
Commodities: Nb, REE
Ore Material: Euxenite
Description of Deposit and Geology: Pegmatite
Production: Unknown
Reference: USGS Map MR-46.

213. Dectectron # 1, 2, 5, 6, and 6A
Location: 33°06'50"N, 112°47'44"W
Sec. 32, T 3S, R 5W; and Sec. 5, T 4S, R 5W; Gila and Salt River Meridian
Commodity: U
Ore Material: Davidite
Description of Deposit and Geology:
Unknown
Production: Unknown
Reference: C.A. Carpenter, written communication to BLM, March 17, 1982 (BLM file).

214. Pegmatite #1
Location: 33°06'35"N, 112°46'59"W

214. Pegmatite #1 (Continued)
Sec. 4, T 4S, R 5W, Gila and Salt River Meridian
Commodities: Ta, Nb, Y, U, Th, Ti, Pb, Ag
Ore Materials: Samarskite and fergusonite
Description of Deposit and Geology:
Minerals are present in Precambrian pegmatite.
Production: Unknown
Reference: C.A. Carpenter, written communication to BLM, March 17, 1982.

215. Pegmatite Placer # 1-6
Location: 33°06'00"N, 112°46'55"W
Secs. 4, and 9, T 4S, R 5W, Gila and Salt River Meridian
Commodities: Nb, Ta, U, Y, Pb, Th, Ti
Ore Materials: Samarskite, fergusonite
Description of Deposit and Geology:
Placer deposit near Pegmatite #1 lode deposit. Pegmatite is of Precambrian age.
Production: Unknown. Some work is being done on the claims.
Reference: C.A. Carpenter, written communication to BLM, March 17, 1982.

216. Unnamed Mineral Occurrence
Location: 33°07'16"N, 112°46'36"W
Sec. 33, T 3S, R 5W, Gila and Salt River Meridian
Commodities: Unknown
Production: Unknown
Reference: USGS Map MR-46.

217. Area of Low-Temperature Geothermal Waters
Location: T 2S, R 5W and R 4W; T 3S, R 4W; T 5S, R 4W; Gila and Salt River Meridian
Reference: Witcher et al., 1982.
Note: Area has one well with water temparature of 32°C and is considered favorable for the discovery and development of low-temperature geothermal waters.

218. Duke, White, and Hyder Claims
Location: 33°12'29"N, 113°14'06"W
Sec. 31, T 2S, R 9W; or Sec. 36, T 2S, R 10W
Commodity: U
Geology: Two times background radioactivity in fetid thin-bedded, gray limestone intercalated with arkosic sandstone.
Production: None
Reference: Scarborough and Wilt, 1979.

219. Thermal Well
Location: 33°02'45"N, 113°02'40"W
Sec. 25, T 4S, R 8W, Gila and Salt River Meridian

219. Thermal Well (Continued)
Reference: Witcher et al., 1982.
Note: Water temperature is 26°C.

222. Wood's Manganese
Location: 33°16'53"N; 113°27'32"W; Sec. 2, T 2S, R 12W; Yuma County; Precision 5 km
Elevation: 365 m: 100 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Prospect
Map Name: Eagle Tail Mountains, 15 min.; Phoenix 2° Quad.
Commodity: Manganese

223. Andzira
Location: 33°17'32"N; 113°29'22"W; Sec. 31, T 1S, R 10W; Maricopa County
Elevation: 488 m: 100 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Unknown
Map Name: Eagle Tail Mountains, 15 min.; Phoenix 2° Quad.
Commodity: Silver

224. H.H. and T. Claims
Location: 33°17'59"N; 113°18'48"W; Sec. 32, T 1S, R 10W; Maricopa County; Precision 500 m
Elevation: 427 m: 100 m
Reference: USBM, 1982, MILS.
Status: Exp. prospect
Operation Type: Surface
Map Name: Eagle Tail Mountains, 15 min.; Phoenix 2° Quad.
Commodities: Copper, gold, silver

227. Mina De La Manana
Location: 33°13'03"N; 114°35'28"W; Sec. 26, T 2S, R 23W; Yuma County; Precision 500 m
Elevation: 244 m: 10 m
Reference: USBM, 1982, MILS.
Status: Exp. prospect
Operation Type: Underground
Map Name: Hidden Valley, 7.5 min.; Salton Sea 2° Quad.
Commodities: Manganese, lead, beryllium, zinc, barium

228. Victory
Location: 33°26'08"N; 113°19'20"W; S-1/2 Sec. 7, T 1N, R 10W; Maricopa County; Precision 500 m
Elevation: 459 m: 100 m
Reference: USBM, 1982, MILS.
Status: Develop. deposit
Operation Type: Underground
Map Name: Eagle Tail Mountains, 15 min.; Phoenix 2° Quad.
Commodity: Copper

229. White Mountain Claims

Location: 33°27'05"N; 113°17'41"W; NW Sec. 9, T 1N, R 10W; Maricopa County; Precision 500 m
Elevation: 457 m: 100 m
Reference: USBM, 1982, MILS.
Status: Raw prospect
Operation Type: Mineral loc.
Map Name: Eagle Tail Mountains, 15 min.; Phoenix 2° Quad.
Commodity: Copper

233. Ten Dee's

Location: 33°52'40"N; 114°04'23"W
Sec. 7, T 6N, R 17W, Gila and Salt River Meridian
Commodities: U, Ba (occurrences)
Ore Materials: Barite, gypsum. No uranium minerals observed. 10X background radiation. Samples contained 0.1 to 131 ppm U_3O_8.
Description of Deposit: Hydroallogenic
Geology: Occurrence is in the Plomosa conglomerate member of the Tertiary Artillery Formation. Mineralization is controlled by a N70°W-trending normal fault and dipping 72°.
Production: None
Reference: Chew and Antrim, 1982.

234. John Hummer Mine

Location: 33°06'06"N; 114°34'03"W; Sec. 6, T 4S, R 22W; Yuma County; Precision 5 km
Elevation: 213 m: 100 m
Reference: USBM, 1982, MILS.
Status: Exp. prospect
Operation Type: Surface
Map Name: Picacho, 7.5 min.; Salton Sea 2° Quad.
Commodities: Mica, Tantalum, silicon, quartz, columbium, silver, feldspar, niobium

236. Black Rock

Location: 33°04'55"N; 113°01'03"W; NE Sec. 18, T 4S, R 7W; Maricopa County; Precision 100 m
Elevation: 183 m: 100 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Unknown
Map Name: Dendora Valley, 15 min.; Phoenix 2° Quad.
Commodity: Pumice

237. Gillespie Dam Area

Location: 33°13'04"N; 112°47'00"W; Sec. 29, T 2S, R 5W; Maricopa County
Elevation: 280 m: 100 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Unknown
Map Name: Woolsey Peak, 15 min.; Phoenix 2° Quad.
Commodity: Pumice

238. Harqua Group
Location: 33°14'17"N; 112°58'39"W; SE Sec. 20, T 2S, R 7W; Maricopa County; Precision 1 km
Elevation: 341 m: 100 m
Reference: USBM, 1982, MILS.
Status: Exp. prospect
Operation Type: Mineral loc.
Map Name: Woolsey Peak, 15 min.; Phoenix 2° Quad.
Commodities: Copper, silver, sulfide, gold

239. Unknown
Location: 33°02'20"N; 114°35'27"W; NW Sec. 36, T 4S, R 23W; Yuma County; Precision 500 m
Elevation: 122 m: 100 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Prospect
Map Name: Picacho, 7.5 min.; Salton Sea 2° Quad.
Commodity: Copper

241. Powers Butte
Location: 33°18'36"N; 112°44'25"W; S-1/2 Sec. 26, T 1S, R 5W; Maricopa County; Precision 500 m
Elevation: 244 m: 100 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Unknown
Map Name: Buckeye, 15 min.; Phoenix 2° Quad.
Commodity: Perlite

244. Brewer Claims
Location: 33°53'33"N; 114°04'04"W; Sec. 6, T 6N, R 17W; Yuma County; Precision 1 km
Elevation: 370 m: 10 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Prospect
Map Name: Bouse, 15 min.; Salton Sea 2° Quad.
Commodities: Iron, hematite-magnetite

245. Meeder Uranium Mine
Location: 33°35'17"N; 114°07'23"W; Sec. 21, T 3N, R 18W; Yuma County; Precision 1 km
Elevation: 427 m: 10 m
Reference: USBM, 1982, MILS.
Status: Raw Prospect
Operation Type: Prospect
Map Name: Quartzsite, 15 min.; Salton Sea 2° Quad.
Commodity: Uranium

246. Blue Rock
Location: 33°35'59"N; 114°07'03"W; E-1/2 Sec. 16, T 3N, R 18W; Yuma County; Precision 100 m
Elevation: 451 m: 10 m

246. Blue Rock (Continued)
Reference: USBM, 1982, MILS.
Status: Raw Prospect
Operation Type: Prospect
Map Name: Quartzsite, 15 min.; Salton Sea 2° Quad.
Commodities: Manganese, silver, barite, sulphate, copper

248. Ayerszona
Location: 33°01'08"N; 114°29'03"W; Sec. 1, T 5S, R 22W; Yuma County
Elevation: Unknown
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Unknown
Map Name: Salton Sea 2° Quad.
Commodity: Gold

251. Copper Queen
Location: 33°37'29"N; 113°56'37"W; S-1/2 Sec. 6, T 3N, R 16W; Yuma County; Precision 100 m
Elevation: 499 m: 10 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Prospect
Map Name: Vicksburg, 15 min.; Phoenix 2° Quad.
Commodity: Copper

252. Thermal Well
Location: 33°48'56"N; 113°51'35"W; NENW Sec. 6, T 5N, R 16W; Yuma County; Precision 100 m
Elevation: 352 m: 10 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Well
Map Name: Utting, 15 min.; Phoenix 2° Quad.
Commodity: Geothermal

253. Thermal Well
Location: 33°48'37"N; 113°51'46"W; SWNW Sec. 6, T 5N, R 15W; Yuma County; Precision 500 m
Elevation: 347 m: 10 m
Reference: USBM, 1982, MILS.
Status: Unknown
Operation Type: Well
Map Name: Utting, 15 min.; Phoenix 2° Quad.
Commodity: Geothermal

255. Murray Placer
Location: 33°36'59"N; 114°06'02"W; Sec. 10, T 3N, R 18W; Yuma County; Precision 1 km
Elevation: 549 m: 10 m
Reference: USBM, 1982, MILS.
Status: Exp. prospect

255. Murray Placer (Continued)
Status: Exp. prospect
Operation Type: Placer
Map Name: Quartszite, 15 min.; Salton Sea 2° Quad.
Commodity: Gold

256. Burro Barite
Location: 33°50'05"N; 114°03'27"W; SESWNW Sec. 29, T 6N, R 17W; Yuma County; Precision 100 m
Elevation: 400 m: 10 m
Reference: USBM, 1982, MILS.
Status: Raw prospect
Operation Type: Unknown
Map Name: Salton Sea 2° Quad.
Commodities: Fluorine, fluorspar, barite

258. Crystal Peak
Location: 33°31'45"N; 114°06'32"W; Sec. 10, T 2N, R 18W; Yuma County; Precision 1 km
Elevation: 488 m: 100 m
Reference: USBM, 1982, MILS.
Status: Exp. prospect
Operation Type: Surface
Map Name: Quartszite, 15 min.; Salton Sea 2° Quad.
Commodities: Gemstone, semiprecious silicates

Mining Claims, Leases, and Material Sites

The most important details pertaining to the mining claims density (number of claims per square mile) in the Kofa GRA and other relevant records are summarized in Tables 2 through 5 and are shown in Figures 9 through 12. Additionally, in the figures, locations and number of potential claims are also shown. All data have been obtained from and are reported after the BLM's records as of June, 1982. It is easy to note that the distribution of claims and their density within the Kofa GRA is very irregular and grouped in certain areas (Figures 9 through 12).

In the Cibola sub-area, most of the unpatented claims are located in the southern part of the South Trigo Mountains WSA (050-023A). In the same area, there are also four patented claims. In the remaining part of the Trigo Mountains WSA, there are only a few single unpatented claims Figure 9).

TABLE 2

CLAIM DENSITY RECORDS IN THE WILDERNESS STUDY AREAS (WSA), CIBOLA SUB-AREA ACCORDING TO BLM (JUNE 1982), ARIZONA STATE OFFICE

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 050-023A South Trigo Mountains						
4S	23W	3	N2 5	Tibbits, Richard/ Sturges, Stephen/ Thomas, Charles Jr./ Smith, Marjory	1981	lode
WSA 050-023B Trigo Mountains						
2S	23W	1	S2 1	Gibson, Jack	none	"
3S	23W	1	NE 1	Yuma Metals, Inc.	1981	"
		12	SW 1	New Jersey Zinc Co.	"	"
		14	SE 1	Hill, Mallie/ Ochoa, Abraham	none	"
		23	SE 2	Adkison, Maxie	1981	"
		24	All 1	"	"	"
			S2 1	"	"	"
			E2 1	"	"	"
			SW 4	"	"	"
			SE 3	Adkison, Maxie/ Peaden, James/ Ferguson, A.W./ Rendernick, J.D./ Warnock, Ed./ Fisher, Don	"	"
		25	All 1	New Jersey Zinc Co.	"	"
			N2 3	"	"	"
			S2 3	"	"	"
			SE 5	"	"	3-ms 2-lode
			W2 3	Yuma Metals, Inc./ Adkison, Maxie	"	
			NW 9	"	"	"
			SW 10	Yuma Metals, Inc./ Adkison, Maxie/ New Jersey Zinc Co.	"	"
			NE 1	Adkison, Maxie	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 050-023B Trigo Mountains (Cont'd.)						
3S	23W	26	E2 1	Adkison, Maxie	1981	lode
			NE 5	"	"	"
			SE 5	"	"	"
			SW 1	"	"	"
		31	W2 1	Yuma Metals, Inc.	1979	"
			SW 1	"	"	"
		34	E2 4	Tibbits, Richard/ Sturges, Stephen/ Thomas, Charles Jr./ Smith, Marjory/ Yuma Metals, Inc.	1981	"
			SE 5	"	"	"
		35	W2 4	"	"	"
			SW 11	"	"	"
			E2 2	Tibbits, Richard/ Sturges, Stephen/ Thomas, Charles Jr./ Smith, Marjory/ Yuma Metals, Inc./ Adkison, Maxie	"	"
			S2 4	Tibbits, Richard/ Sturges, Stephen/ Thomas, Charles Jr./ Smith, Marjory	"	"
			NW 3	Tibbits, Richard/ Sturges, Stephen/ Thomas, Charles Jr./ Smith, Marjory/ Adkison, Maxie	"	"
			NE 7	Yuma Metals, Inc./ Adkison, Maxie	"	"
			SE 2	"	"	"
4S	23W	2	S2 3	Yuma Metals, Inc.	1979	"
			W2,SE 1	"	"	"
			NW 2	"	"	"
			SE 2	"	"	"
		3	NE 5	Tibbits, Richard/ Sturges, Stephen/ Thomas, Charles Jr./ Smith, Marjory	1981	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 050-023B Trigo Mountains (Cont'd.)						
4S	23W	18	SW 1	Hoyt, Joe L.	1981	lode
		19	NW 1	"	"	"
WSA 050-033 Kofa Unit 4 Northern Addition						
2S	19W	29	N2 2	Yuma Zeolite Corp.	1979	"
			W2 3	"	"	"
			NW 8	"	"	"
			SW 3	"	"	" c.c.4/26/82 on 2 claims

TABLE 3

CLAIM DENSITY RECORDS IN THE WILDERNESS STUDY AREAS (WSA), BRENDA SUB-AREA
ACCORDING TO BLM (JUNE 1982), ARIZONA STATE OFFICE

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
			WSA 020-125 New Water Mountains			
3N	14W	18	SW 4	Russell, Joseph/ Gadberry, William/ Martinez Y Martinez	1981	lode
		19	NW 5	"	"	"
		33	NW 1	Wolff, Donald/ Zweifel, Merle/ Odergaarden, Margaret	none	placer
			SW 1	Wolff, Donald/ Zweifel, Merle/ Odergaarden, Margaret/ Mitchell, Marcia Parker, Pat	"	"
			NE 1	"	"	"
			SE 1	"	"	"
		34	NW 1	"	"	"
			SW 1	"	"	"
			NE 1	"	"	"
			SE 1	"	"	"
3N	16W	7	N2 1	Burney, William	none	lode
			N2,SW 1	"	"	"
			NE 4	"	"	"
			E2 1	Speer, Jean/ Moore, Sandra/ Hovatter, Barbara	1981	"
			N2,SE 1	"	"	"
			SE 2	"	"	"
		8	S2 3	"	"	"
			SW 4	"	"	"
			SE 3	"	"	"
			NW 1	Burney, William	none	"
		11	W2 2	Russell, Joseph/ Gadberry, William/ Martinez Y Martinez	1981	"
			S2 1	"	"	"
			SW 8	"	"	"
			SE 1	"	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 020-125 New Water Mountains (Cont'd.)						
3N	16W	13	W2 3	Russell, Joseph/ Gadberry, William/ Martinez Y Martinez	1981	lode
			E2 1	"	"	"
			S2 2	"	"	"
			W2,SE 1	"	"	"
			N2,SE 2	"	"	"
			NW 4	"	"	"
			SW 8	"	"	"
			SE 6	"	"	"
		14	All 1	"	"	"
			N2 4	"	"	"
			S2 1	"	"	"
			W2 3	"	"	"
			E2 3	"	"	"
			N2,SW 1	"	"	"
			NW 8	"	"	"
			SW 1	"	"	"
			NE 7	"	"	"
			SE 7	"	"	"
		15	N2 1	"	"	"
			E2 1	"	"	"
			S2 1	Speer, Jean/ Moore, Sandra/ Hovatter, Barbara	"	"
			NW 1	"	"	"
			SW 4	"	"	"
			SE 6	Russell, Joseph/ Gadberry, William/ Martinez Y Martinez/ Speer, Jean/ Moore, Sandra/ Hovatter, Barbara	"	"
			NE 8	"	"	"
		16	N2 2	Speer, Jean/ Moore, Sandra/ Hovatter, Barbara	"	"
			E2 2	"	"	"
			NW 2	"	"	"
			NE 5	"	"	"
			SE 3	"	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
			WSA 020-125 New Water Mountains (Cont'd.)			
3N	16W	17	N2 3	Speer, Jean/ Moore, Sandra/ Hovatter, Barbara	1981	lode
			E2 1	"	"	"
			NE 8	"	"	"
		21	NE 4	"	"	"
		22	E2 2	"	"	"
			NW 3	"	"	"
			N2 4	Russell, Joseph/ Gadberry, William/ Speer, Jean/ Moore, Sandra/ Hovatter, Barbara	"	"
			NE 17	"	"	"
		23	SW 1	Speer, Jean/ Moore, Sandra/ Hovatter, Barbara	"	"
			W2 2	Russell, Joseph/ Gadberry, William/ Speer, Jean/ Moore, Sandra/ Hovatter, Barbara/ Martinez Y Martinez		
			NW 11	"	"	"
			NE 4	"	"	"
		24	All 2	Russell, Joseph/ Gadberry, William/ Martinez Y Martinez	"	"
			N2 4	"	"	"
			S2 1	"	"	"
			W2 1	"	"	"
			E2 2	"	"	"
			NW 7	"	"	"
			NE 8	"	"	"
3N	17W	2	E2 1	Ramsey Mine Property	"	"
			NE 1	"	"	"
			SE 2	"	"	"
		12	NW 1	"	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 020-125 New Water Mountains (Cont'd.)						
4N	17W	36	All 1	Burney, William	none	lode
			S2 1	"	1981	"
			SW 3	"	"	"
			SE 4	"	"	"
			N2,SE 1	Patch, Dan	"	"
3N	18W	1	SW 12	Rice, George/ Evans, Anne/ Arnold, Joseph/ Fikel, J.F.	"	"
			SE 4	Daily, C.L./ Wilson, Richard/ Sorensen, Gary	"	" c.c.6/1/82
			SE 1	Daily, C.L./ Wilson, Richard/ Sorensen, Gary/ Gable, Howard/ Kerr, Glenn	"	lode
		12	NW 7	Rice, George/ Evans, Anne/ Arnold, Joseph/ J.B. Mining Co.	"	"
			NE 2	Daily, C.L./ Wilson, Richard/ Sorensen, Gary/ Gable, Howard/ Kerr, Glenn/ Rice, George/ Evans, Anne/ Arnold, Joseph	"	"
			NE 4	Daily, C.L./ Wilson, Richard/ Sorensen, Gary	none	" c.c.6/1/82
		24	NW 1	Sowell, James/ Williams, Dorothy	1981	lode c.c.5/25/82
			SW 2	"	"	"
		35	S2 1	Baynham, Wilhemina	"	lode
			SE 1	"	"	"
			SW 1	Wall, J.R./ Quiroga, Rigo/ Rico, Dan/ Brown, Carl	"	placer

TABLE 4

CLAIM DENSITY RECORDS IN THE WILDERNESS STUDY AREAS (WSA), EAGLE TAIL SUB-AREA ACCORDING TO BLM (JUNE 1982), ARIZONA STATE OFFICE

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 020-126A Little Horn Mountains West						
1N	14W	15	N2 1	F. Marshall Smith Con.	none	lode
			S2 1	"	"	"
			SW 2	"	"	"
		22	N2 1	"	"	"
			NW 2	"	"	"
		35	NE 1	"	"	"
			SW 1	"	"	"
			E2 2	F. Marshall Smith Con./ Nohr, Gary	"	"
			NW 2	"	"	"
			SE 8	"	"	"
		36	S2 1	F. Marshall Smith Con.	"	"
			SW 5	Nohr, Gary	"	"
WSA 020-127 Little Horn Mountains East						
1N	13W	16	SW 1	Hansen, Wayne	"	"
		17	W2 20	"	"	"
		32	S2 1	West, Glenn	1981	"
			SE 3	West, Glenn/ McCaw, John	"	"
			SW 1	Phillips, Wayne D.	"	"
1S	13W	6	S2 1	F. Marshall Smith Con.	none	"
			W2 2	"	"	"
			N2 1	"	"	"
			NW 6	"	"	"
			SW 8	"	"	"
			NE 2	"	"	"
			SE 1	"	"	"
		7	N2 2	"	"	"
			NW 2	"	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 020-127 Little Horn Mountains East (Cont'd.)						
1S	14W	1	All 1	F.Marshall Smith Con.	none	lode
			S2 3	"	"	"
			E2 3	"	"	"
			W2 1	"	"	"
			NE 5	"	"	"
			SW 5	"	"	"
			SE 6	"	"	"
			N2 6	Hermoso Oro, Inc./ F.Marshall Smith Con.	1981	"
			NW 7	Hermoso Oro, Inc./ F.Marshall Smith Con./ Nohr, Gary	"	"
		11	W2 2	F.Marshall Smith Con./ Hermoso Oro, Inc.	"	"
			SW 6	F.Marshall Smith Con./ Hermoso Oro, Inc./ Morgan, George W./ Clark, Dixie	"	"
		12	N2 2	F.Marshall Smith Con.	none	"
			W2 1	"	"	"
WSA 020-128 Eagle Tail Mountains						
1N	10W	17	N2 1	Wister, William/ Wiberg, Carol	"	"
1S	10W	2	SE 2	Baker, Lucille B.	1981	"
WSA 020-129 Clanton Well						
2S	10W	4	NW 2	Morgan, George W./ Craig, D.	"	"
		5	N2 5	Morgan, George W.	"	"
			S2 3	"	"	"
			E2 3	"	"	"
			All 1	"	"	"
			NW 7	"	"	"
			SW 2	"	"	"
			NE 4	"	"	"
			SE 2	"	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 020-129 Clanton Well (Cont'd.)						
2S	11W	15	SW 1	Morgan, George W.	1981	lode
			E2 2	Craig, L.D.	"	"
		16	E2 1	Morgan, George W.	"	"
			NE 2	"	"	"
		24	NE 2	Rose, A.M.	none	"
3S	10W	7	E2 2	Smith, L.D. Jr.	"	"
			S2 2	"	"	"
			N2 1	"	"	"
			NE 2	"	"	"
			NW 1	"	"	"
			SE 10	Conde, D./ Menhaden, Inc./ Smith, L.D. Jr.	1982	"
3S	11W	2	N2 4	Morgan, George W.	1981	"
			W2 1	"	"	"
			E2 2	"	"	"
			All 1	"	"	"
			SE 9	"	"	"
			NE 8	"	"	"
			NW 1	"	"	"
		9	E2 1	Craig, L.D.	"	"
		10	W2 2	"	"	"
			SE 5	Morgan, George W.	"	"
		11	S2 3	"	"	"
			SW 6	"	"	"
			NE 4	"	"	"
		12	N2 2	"	"	"
			NE 5	"	"	"
			NW 4	"	"	"
		13	SE 2	Rose, A.M.	none	"
		14	NW 3	Morgan, George W.	1981	"
		15	S2 2	"	"	"
			W2 3	"	"	"
			N2 1	"	"	"

TABLE (Cont'd.)

WSA 020-129 Clanton Well (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
3S	11W	15	All 1	Morgan, George W.	1981	lode
			NE 9	"	"	"
			NW 3	"	"	"
			SW 1	"	"	"
			E2 2	Craig, L.D.	"	"
		16	E2 1	Morgan, George W.	"	"
			NE 2	"	"	"
		24	NE 2	Rose, A.M.	none	"

TABLE 5

CLAIM DENSITY RECORDS IN THE WILDERNESS STUDY AREAS (WSA), SADDLE SUB-AREA
ACCORDING TO BLM (JUNE 1982), ARIZONA STATE OFFICE

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
			WSA 020-136 Face Mountain			
2S	9W	30	1	Barvinchak, C.	none	lode
3S	9W	6	SW 3	McDonald, J.R.	1981	"
			S2 1	McDonald, Isetta L.	"	"
		7	E2 1	"	"	"
			SE 5	"	"	"
			N2 1	Mrcopa Gold Miners	"	"
			W2 2	"	"	"
			NW 8	Suns of Light/ Mrcopa Gold Miners	"	"
		8	S2 1	McDonald, Isetta L.	"	"
			SW 5	"	"	"
			WSA 020-138 Signal Mountain			
2S	6W	17	All 1	Hamblen, James E.	"	"
			S2 3	"	"	"
			W2 2	"	"	"
			N2 4	"	"	"
			SW 8	"	"	"
			NW 7	"	"	"
		18	All 1	"	"	"
			W2 1	"	"	"
			S2 4	"	"	"
			N2 2	"	"	"
			E2 2	"	"	"
			SW 4	"	"	"
			NW 1	"	"	"
			SE 8	"	"	"
			NE 6	"	"	"
		19	N2 3	"	"	"
			NW 4	"	"	"
			NE 4	"	"	"
		20	N2 2	"	"	"
			NW 4	"	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 020-138 Signal Mountain (Cont'd.)						
2S	6W	29	All 1	Brock, C.	1981	lode
			N2 1	"	"	"
			W2 4	"	"	"
			NW 4	"	"	"
			NE 1	"	"	"
			E2 2	Brock, C./ Henkle, William Jr./ McGowan, V.	"	"
			SW 1	Henkle, William Jr.	"	"
			SE 3	Smith, Norman L.	"	"
		30	E2 1	Brock, C.	"	"
			NE 1	"	"	"
		32	E2 2	Smith, Norman L.	"	"
			NE 6	Henkle, William Jr./ Smith, Norman L.	"	"
2S	7W	13	All 1	Hamblen, James	"	"
			N2 1	"	"	"
			S2 4	"	"	"
			W2 1	"	"	"
			E2 1	"	"	"
			SE 4	"	"	"
			SW 4	"	"	"
			NW 1	"	"	"
		20	S2 4	Pease, Clarence	none	"
			SE 8	"	"	"
			N2 7	Pease, Clarence/ Roye, T./ Asbury, Wade	"	"
			NE 11	"	"	"
			E2 1	Roye, T./ Asbury, Wade	"	"
		21	W2 2	"	"	"
			NW 11	Pease, Clarence/ Roye, T./ Asbury, Wade	"	"
			SW 8	Pease, Clarence	"	"
		24	N2 4	Hamblen, James	1981	"
			NW 4	"	"	"
			NE 4	"	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section	Claimants	Latest Assmt. Date	Remarks
WSA 020-138 Signal Mountain (Cont'd.)						
2S	7W	28	NW 10	Pease, Clarence	none	lode
			SW 4	"	"	"
		29	N2 4	"	"	"
			S2 2	"	"	"
			E2 1	"	"	"
			NE 9	"	"	"
			SE 4	"	"	"
WSA 020-142/144 Woolsey Peak						
3S	5W	32	S2 3	Carpenter, Charles	1981	"
			SW 1	"	"	"
		33	SE 1	Tiffany, Garry/ Alberts, E.	none	"
		34	SE 2	"	"	"
			NW 1	Stringfellow, S.	"	"
			SW 2	Yanez, R./ Tiffany, Garry/ Alberts, E.	1981	"
		35	S2 1	Tiffany, Garry/ Alberts, E.	none	"
			SW 1	"	"	"
			NW 1	Yanez, R.	1981	"
			NE 1	Stringfellow, S./ Bass, H.	none	"
4S	5W	3	All 1	Lemons, John	"	"
			S2 1	"	"	"
			SW 1	"	"	"
			SE 5	"	"	"
			E2 6	Lemons, John/ Hansen, E.		
		4	All 1	Carpenter, Charles	"	"
			NW 2	"	1981	"
			SW 4	"	"	"
			SE 1	Lemons, John	"	"

TABLE (Cont'd.)

Township	Range	Section	Claims For Each Section		Claimants	Latest Assmt. Date	Remarks
					WSA 020-142/144 Woolsey Peak (Cont'd.)		
4S	5W	5	All	1	Carpenter, Charles	none	lode
			N2	1	"	1981	"
			NW	1	"	"	"
			NE	1	"	1979	"
		9	NW	1	"	none	"
			NE	1	Lemons, John	1981	"
2S	6W	33	All	1	Smith, Norman	"	"
			N2,SW	1	"	"	"
			W2	2	"	"	"
			SW	4	"	"	"
			N2	2	Smith, Norman/ Lemons, Clyde	"	"
			NE	4	"	"	"
			NW	14	Smith, Norman/ Henkle, William Jr.	"	"
			S2	4	Lemons, Clyde	"	"
			E2	2	"	"	"
			SE	6	"	"	"
		34	SW	4	"	"	"
			NW	2	"	"	"
3S	6W	4	N2	2	"	"	"
			NE	3	"	"	"

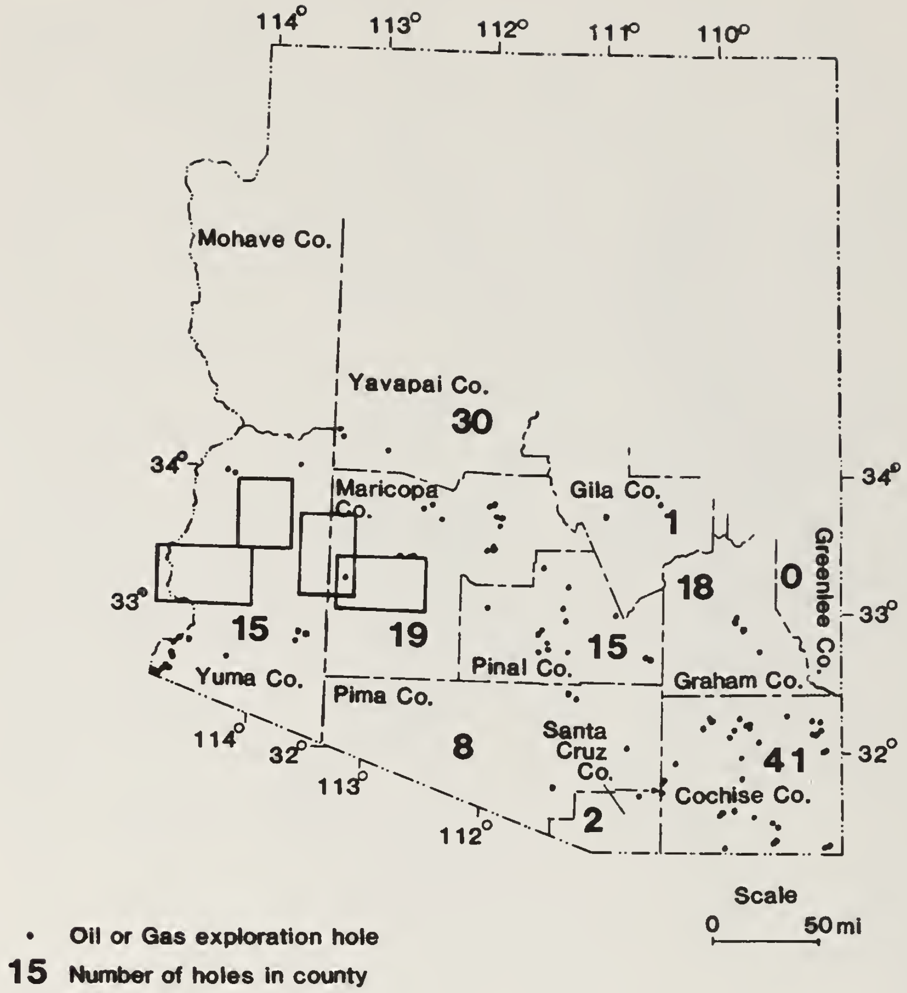


FIG. 8. LOCATION OF OIL AND GAS EXPLORATION HOLES IN SOUTHERN ARIZONA, after Jones (1979).

A very high density area of mining claims, with 55 patented claims, is located within the central part of the Brenda WSA (020-125; Figure 10).

Distribution of the mining claims in the Eagle Tail sub-area do not follow any specific pattern, and most of them are located in the southern part of the Clanton Well WSA and the western part of the Little Horn Mountains East WSA (see Figure 11). In this sub-area, there are no patented claims.

Also, in the Saddle sub-area, mining claims are located in only three areas. Most of them cover the northern part of the Signal Mountain WSA (020-138) and its proximity to the northeast and north. Forty-two unpatented claims are located in the eastern part of the Woolsey Peak WSA (020-142/144) and 28 claims are posted in the northwestern part of the Face Mountain WSA (020-136; Figure 12).

In spite of special efforts, particularly with regard to patented claims, we were unable to determine the specific types of deposits for which these claims were filed. However, many claims coincide with mining prospects and mines of which main commodities are also indicated on the geologic, energy and mineral resources maps (Figures 3 through 6).

During this study, we have also thoroughly investigated the status of oil and gas leases. As a result, an outline of all land currently either fully or partially leased within and in close proximity of each specific WSA within the Kofa GRA is shown together with the claim density (see Figures 9 through 12). It can be noted, too, that much of the federal and fee land is leased for oil and gas exploration for five or ten year terms.

Mineral Deposits Types

Geological environments to be considered as potentially favorable for the occurrence of mineral or energy resources include the following:

Older Precambrian igeneous and metamorphic rocks

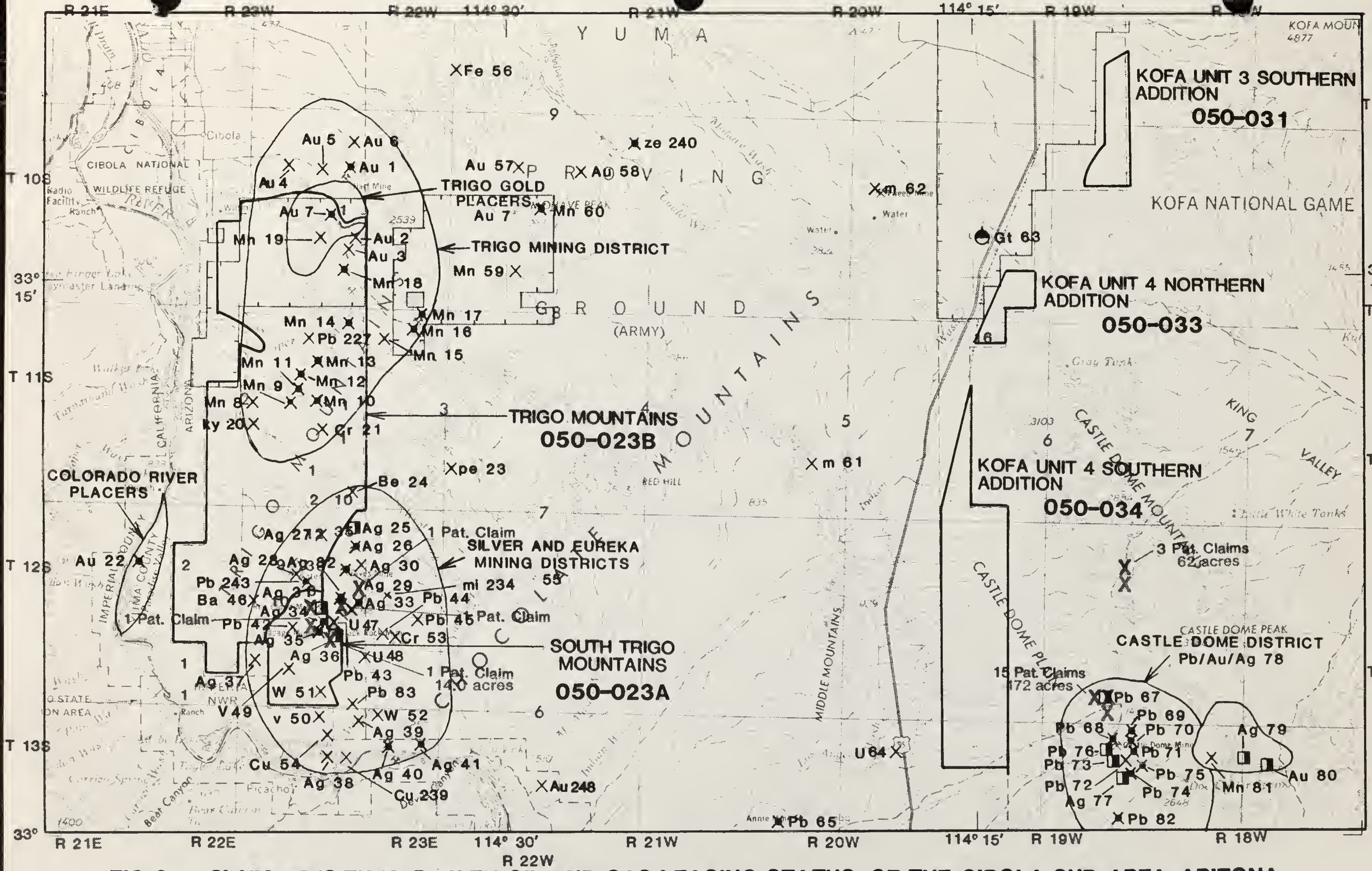


FIG. 9 CLAIM DENSITY MAP, WITH OIL AND GAS LEASING STATUS, OF THE CIBOLA SUB-AREA, ARIZONA.

Note: hachured lines enclose oil and gas leases; numbers are claims per section.

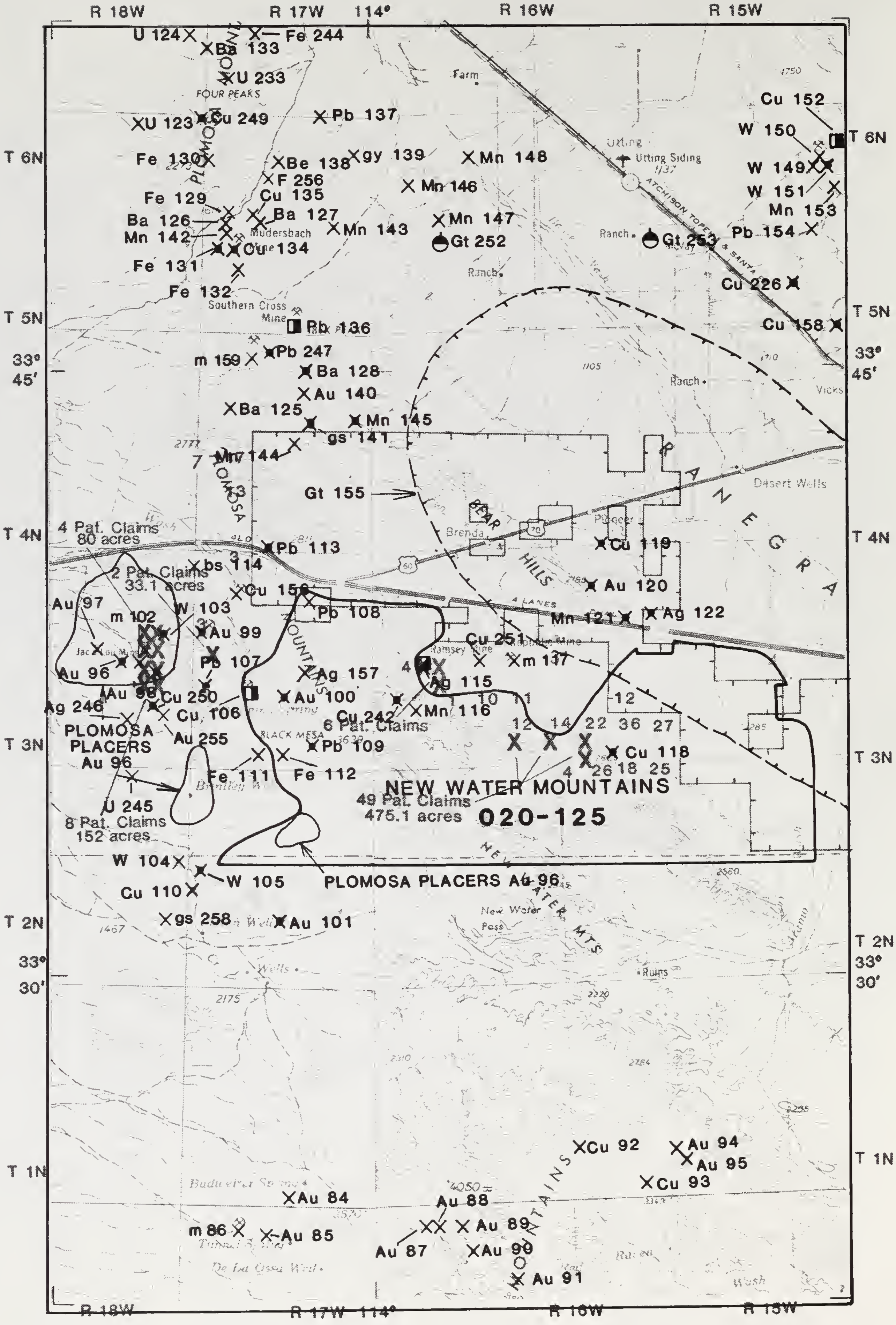


Fig.10 CLAIM DENSITY MAP, WITH OIL AND GAS LEASING STATUS, OF THE BRENDA SUB-AREA, ARIZONA.

Note: hachured lines enclose oil and gas leases; numbers are claims per section.

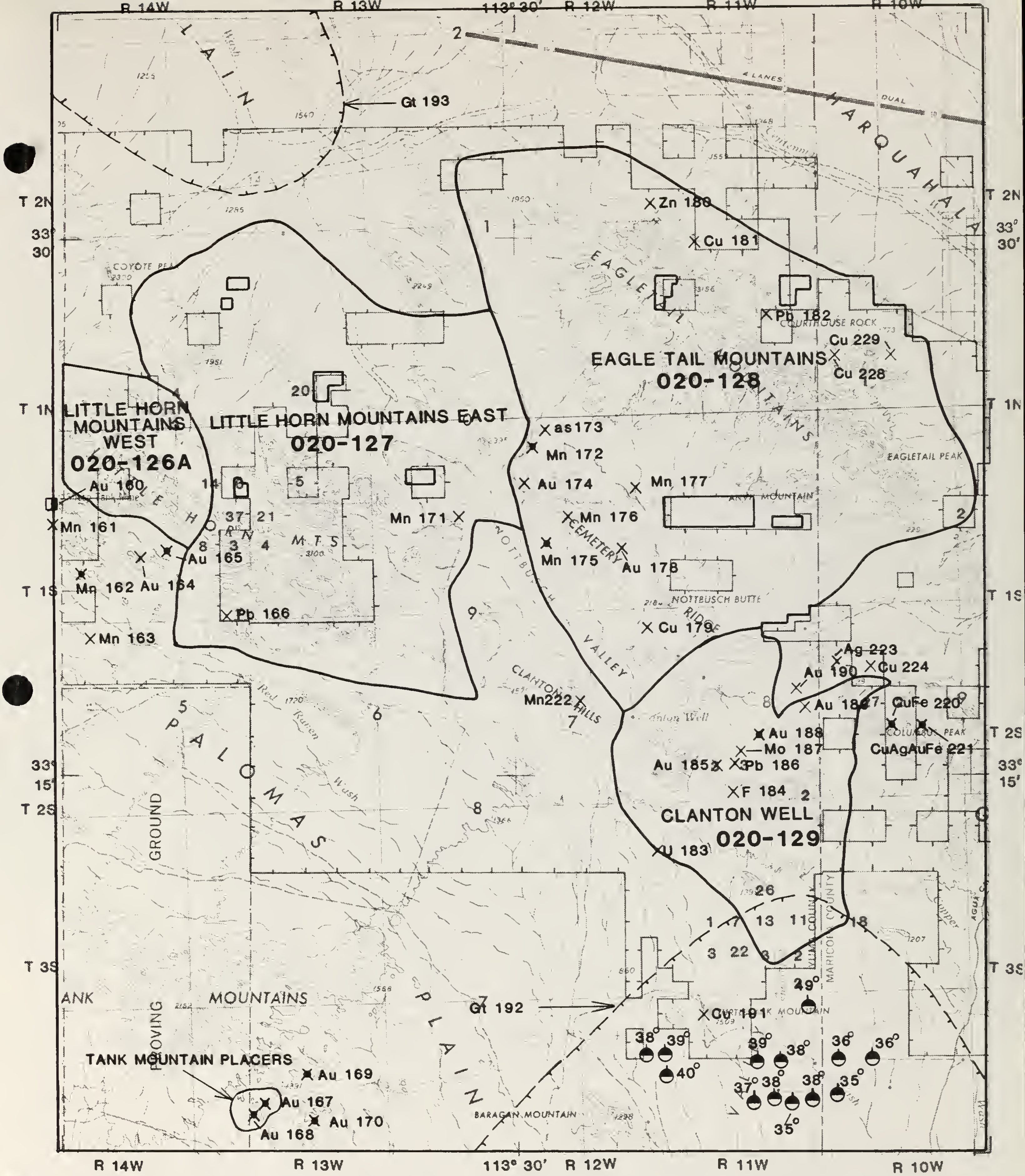


Fig.11 CLAIM DENSITY MAP, WITH OIL AND GAS LEASING STATUS, OF THE EAGLE TAIL SUB-AREA, ARIZONA.

Note: hachured lines enclose oil and gas leases; numbers are claims per section.

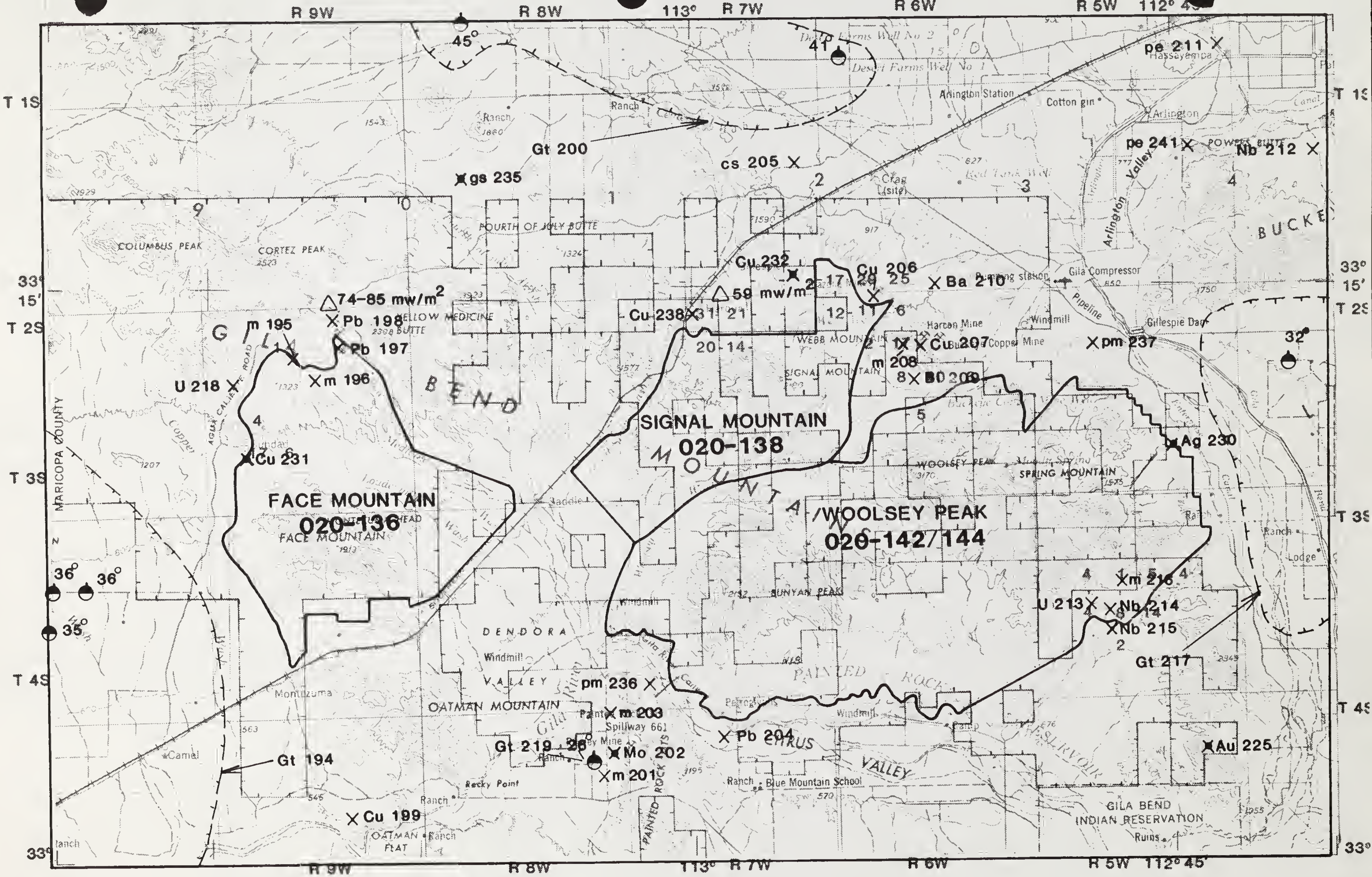


Fig.12 CLAIM DENSITY MAP, WITH OIL AND GAS LEASING STATUS, OF THE SADDLE SUB-AREA, ARIZONA.
Note: hachured lines enclose oil and gas leases; numbers are claims per section.

Paleozoic and Mesozoic sediments

Jurassic arc intrusive rocks

Laramide intrusive rocks

Mid-Tertiary metamorphic core complexes

Mid-Tertiary volcanic rocks

Mid-Tertiary basin-fill sediments

Late Tertiary basin-fill sediments

Recent alluvium

Active geothermal systems

Older Precambrian Igneous and Metamorphic Rocks

Older Precambrian rocks are possible hosts for volcanogenic massive sulfide deposits and pegmatitic deposits associated with intrusion of Precambrian granites.

Numerous occurrences of massive sulfide deposits are found in the Precambrian rocks in Arizona. They are invariably associated with submarine rhyolitic volcanism (Donnelly and Hahn, 1981) and are either of the proximal or distal type (Anderson and Guilbert, 1979). The proximal deposits are copper- and locally zinc-rich and were formed above or on the flanks of rhyolitic centers; the distal ones are zinc- and lead-rich, contain silver and gold, and were formed at the same time but in an adjacent basin. The massive sulfide deposits are associated with banded iron formations which are zoned, with sulfide facies near the rhyolitic center and carbonate and hematite facies more distantly (Anderson and Guilbert, 1979). Metavolcanic rocks occur in the Yavapai Series and in the gneissic terrain to the northwest; both lie to the northwest of the Holbrook Line (see Figure 2) which separates them from the non-volcanogenic Pinal Schists. The southwesterly extension of the Holbrook Line passes through the center of the Saddle sub-area (see Figure 2).

Volcanogenic massive sulfide depsits are thus more likely to occur in Precambrian metamorphic rocks to the northwest of this line.

In the east-central part of the Eagle Tail sub area and in the western and central parts of the Saddle sub-area, small lead, gold, molybdenum, bismuth, and barium veins are present in Precambrian schists and gneisses. There is no evidence for the presence of massive sulfide deposits or banded iron formations that could be of Precambrian volcanogenic origin, and the deposits are more likely to be related to Tertiary volcanics which occur nearby. Little or no production is recorded from mine deposits.

In the east-central part of the Saddle sub-area, pegmatites enriched in Nb, Ta, Y, U, Th, Ti, Pb, Ag, and containing samarskite, fergusonite and davidite intrude Precambrian granites, and are probably related to the emplacement of these granites. No production is recorded from these deposits.

Paleozoic and Mesozoic Sediments

Paleozoic and Mesozoic sediments are potential hosts for hydrocarbon deposits, red-bed-type copper and silver deposits, and metamorphic hydrothermal deposits.

Paleozoic and Mesozoic sedimentary rocks in southwestern Arizona have been considered as potentially favorable for the accumulation of hydrocarbons, especially in the Overthrust Belt (Peirce, 1982; Keith, 1980). All exploration holes drilled to date, however, have been dry (Peirce, 1982; Keith, 1981; Peirce, 1979; see Figure 4). In the Kofa GRA, one such dry hole has been drilled in the southern area of the Saddle sub-area (Figure 8).

Paleozoic sedimentary rocks crop out only in the Brenda sub-area. Potential source rocks for hydrocarbons are possibly the shales and fetid limestones in the Abrigo and Martin Formations. Potential reservoir rocks in-

Table 6. GEOLOGICAL ENVIROMENTS OF THE KOFA AREA AND ASSOCIATED POTENTIAL MINERAL DEPOSIT TYPES

MINERAL DEPOSIT TYPE GEOLOGICAL ENVIROMENT – HOST ROCKS	Volcanogenic Massive Sulfide Deposits	Hydrothermal Deposits (Igneous and Metamorphic)	Porphyry Copper Deposits	Replacement and Skarn Deposits	Tin–Tungsten Deposits (S–Type Granite)	Pegmatite Deposits (Nb, Ta, Y, etc.)	"Red–Bed" Type Deposits (Cu±Ag)	Placer Deposits	Hydrocarbon Deposits	Uranium Deposits (all types)	Low–Temperature Geothermal Waters
Active Geothermal Systems											X
Recent Alluvium								X			
Late Tertiary Basin–Fill Sediments										X	X
Mid–Tertiary Basin–Fill Sediments										X	X
Mid–Tertiary Volcanic Rocks		X									
Mid–Tertiary Metamorphic Core Complexes		X		X						X	
Laramide Intrusives		X	X	X	X						
Jurassic Intrusives		X	X								
Paleozoic and Mesozoic Sediments		X		X			X		X		
Older Precambrian Igneous and Metamorphic Rocks	X					X				X	

clude the above mentioned formations, the Supai Formation and the Coconino Sandstone.

The Mesozoic sediments are non-marine, are not known to be rich in organic matter, and are unlikely to be good source rocks for hydrocarbons. Locally they may be effective reservoir rocks.

The Paleozoic and Mesozoic sediments have undergone deformation during the mid-Mesozoic, Laramide, and mid-Tertiary orogenies and during Basin and Range faulting and structurally are extremely complex. In addition, the Mesozoic rocks in the western part of the Cibola, the northern portion of the Brenda, and in the entire Eagle Tail sub-areas have undergone metamorphism to schists and gneisses. Thus, they are not considered favorable for the accumulation of hydrocarbons. However, it should be noted that recent drilling activity in southern Arizona results from interpretation of seismic data which suggests that large thrust sheets are present in the area (Peirce, 1982; Keith, 1980; Anschutz, 1980). Rocks cropping out at the surface may have been thrust over Paleozoic and Mesozoic sediments which are potentially favorable for accumulation of hydrocarbons. We have no evidence to support or refute such an interpretation except to note that one hole drilled near Florence on the basis of such an interpretation bottomed in granite at 18,000 feet (Keith, 1981).

The thick Mesozoic sedimentary red beds in the Brenda sub-area are potentially favorable for the occurrence of red-bed-type copper-silver deposits such as are present in Permian and Triassic rocks in central and northern New Mexico (LaPoint, 1979, 1974a, 1974b). No occurrences of this type are known in the GRA, but the presence of a thick section of permeable terrestrial sandstones and conglomerates interbedded with playa evaporite deposits suggest that a favorable environment for such deposits could be present in the area. The associated red bed and evaporite deposits suggests the possibility that the environment may have been favorable for the formation of deposits by a Sabkha-type process (Renfro, 1974).

Metamorphosed Mesozoic rocks could also host hydrothermal deposits in which the fluids and metals were derived during dehydration reactions accompanying prograde metamorphism as described by Hutchinson et al. (1980). In the west-central portion of the Brenda sub-area, small scheelite and gold-bearing quartz veins and pegmatites in Mesozoic schists may have been formed by such a mechanism. The deposits are small and have produced only a few hundred tons of ore and about 100 units WO_3.

Jurassic Arc Intrusives

During the mid-Jurassic, a magmatic arc extended across much of the Kofa GRA (Dickinson, 1981; see Figure 2). Porphyry copper mineralization is associated with Jurassic igneous rocks at Bisbee to the southeast of the GRA; and according to Titley (1982), the Jurassic represents a metallogenic epoch in the southwest warranting exploration. There is no known mineralization within the Jurassic intrusive rocks, but in the southern Plomosa Mountains in the Brenda sub-area, several deposits are located close to an intrusive contact. These deposits include: a copper-silver deposit along a thrust fault in Paleozoic limestone and Mesozoic red beds; a gold quartz vein along a shear in Paleozoic sediments; copper, lead and silver replacement of a Paleozoic limestone; an undescribed silver occurrence; and two iron occurrences. This concentration of mineralization near the Jurassic intrusive suggests that the hydrothermal deposits may be genetically related to this intrusive.

Laramide Intrusive Rocks

The Laramide was a time of emplacement of all but one (Bisbee) of the porphyry deposits in Arizona and adjacent New Mexico and Mexico. Of the 35 major porphyry copper deposits in this region, 32 lie to the southeast of the Holbrook Line where basement is Pinal Schist, and 3 lie to the northwest where basement consists of the Yavapai Series and gneissic-metavolcanic terrain (see Figure 2). The intrusives associated with the porphyry copper deposits were emplaced during the westward sweep of the magmatic arc (Clark, 1982; Damon et al., 1981) and possibly related to the decrease in the dip of the Benioff zone at this time (Coney and Reynolds, 1980). The porphyry copper deposits appear to be aligned along northwest and east-northeast trends (see Figure 2; Heidrick and Titley, 1982). The northwesterly trend is sub-parallel to Mesozoic linear discontinuities in depositional patterns (Titley, 1976); the trend of Laramide basement-cored uplifts and thrust faults (Nielsen, 1979; Davis, 1981); the Texas zone of Schmitt (1966); and the trend of the Laramide magmatic arcs. The ENE trend is sub-parallel to Precambrian fold axes and to Laramide tensional features (Rehrig and Heidrick, 1976). The intrusions related to the porphyry copper deposits are small in area (seldom over 3 km^2) and may have been emplaced along the NW and ENE structural intersections (Titley, 1981).

None of the major northwest or east-northeast trends of porphyry copper deposits pass through the GRA, but Laramide intrusives are found in the northwestern and northeastern parts of the Brenda sub-area and in the northern part of the Eagle Tail sub-area. Associated with the northwestern intrusion in the Brenda sub-area is a hematite skarn deposit and a small (production of 200 tons) chalcopyrite, bornite, pyrite replacement deposit in Mesozoic schist and limestone. Associated with the northeastern intrusion in the Brenda sub-area are a small vein copper deposit (production of 8,600 tons of

2.3% Cu) in adjacent Mesozoic schist, and two quartz scheelite veins (production of 600 units WO_3) also cutting adjacent Mesozoic schist. The Laramide intrusive in the northern area of the Eagle Tail sub-area is not known to be associated with any metallic mineralization.

The reason for the apparent absence of porphyry copper deposits from the GRA is not known but could be the result of one or more of the following factors:

1. The area is probably underlain by Yavapai Series basement, whereas 32 of 35 major porphyry copper deposits in the southwest are in Arizona where the basement consists of Pinal Schists (see Figure 2).
2. Most of the Laramide intrusives in this area are peraluminous, possibly S-type, granites. These are generally not associated with porphyry copper-molybdenum-gold deposits but rather with tin-tungsten deposits (Burnham, 1981).
3. Erosion during post-Laramide time may have progressed to deep levels removing the shallower portions of intrusives. The presence of muscovite in several of the intrusives suggests that the level of exposure is indeed deep. The presence of tungsten mineralization also supports a relatively deep level of exposure because, as shown by Newberry and Einaudi (1981), tungsten skarns typically form at deep levels.
4. The GRA is extensively covered by mid-Tertiary volcanics which may hide porphyry copper deposits.

In the light of the above discussion, it is considered that the GRA overall has only a low to moderate favorability for the occurrence of porphyry copper deposits.

Mid-Tertiary Metamorphic Core Complexes

The potential for mineral deposits associated with metamorphic core complexes is not well known as it is only during the last decade or so that the complexes themselves have been widely recognized. In an important work, Coney and Reynolds (1980) and several co-workers attempted to assess uranium favorability of these complexes; and in so doing, they have also provided useful information on some other elements. Some important findings of this study, which also includes the report by Keith and Reynolds (1980), are as follows:

1. Uranium related to plutonic processes tends to be associated with potassium-rich rocks ($K_2O > 4\%$).
2. Uranium related to metamorphic processes may be transported by fluids released through dehydration reactions. Geochemical studies by Keith and Reynolds (1980) show that mylonitization is not associated with any changes in U or Th concentration. However, the rich uranium deposit of Graeber Lease in the Kettle metamorphic core complex, Washington, occurs in mylonitic gneisses and may be of metamorphic origin (Reynolds, 1980).
3. The dislocation surface and the underlying chloritic breccia represent a permeable horizon along which fluids migrated (Reynolds, 1980). Geochemical studies of the metamorphic core complexes in the Rawhide Mountains (located 20 to 25 miles north of the Kofa GRA) by Keith and Reynolds (1980) show that these rocks are enriched in U, Th, Cu, Zn, Fe, V, Li, and Cr compared to the protolith, and contain uranium occurrences and more widespread hematite, limonite, Cu, and Au mineralization. Coney and Reynolds (1980) consider that investigation of these zones downdip into the nearby basins may be worthwhile.

Near the Kofa GRA, metamorphic core complexes occur to the north and northeast of the Brenda sub-area and to the north of the Eagle Tail sub-area. The Rawhide Mountains, referred to above, lie to the north of the Brenda sub-area. The dislocation surfaces related to these or other metamorphic core complexes and possibly enriched in uranium, copper, and gold could underlie the basins beneath the Rangegras and Harquahala Plains in the northern parts of the Brenda and Eagle Tail sub-areas.

Mid-Tertiary Volcanic Rocks

In southern Arizona, southwestern New Mexico, and Mexico, mid-Tertiary volcanics are very common, and contain gold-silver and base metal lode deposits (Damon et al., 1981; Clark et al., 1982). The volcanics were erupted when the magmatic arc swept rather rapidly westward, possibly as a result of the steepening of the Benioff zone (Coney and Reynolds, 1977). In southwestern New Mexico, the deposits are associated with cauldrons from which voluminous ignimbrites and other volcanics were erupted (Elston, 1978). As yet, no such cauldrons have been identified in Arizona, but the voluminous ignimbrites and existing numerous deposits suggest that such cauldrons could be present.

The mid-Tertiary volcanic rocks crop out throughout the GRA; and in the ranges, they constitute by far the most abundant rock type. They range in composition from basalt to rhyolite and include intrusives, flows, ignimbrites, and a variety of tuffs. They constitute part of the Kofa volcanic field.

The majority of the mineral deposits and occurrences present in the GRA are probably genetically related to these rocks. Many of these occurrences are grouped into fairly well-defined districts which may be related to volcanic centers, cauldrons, and/or sub-volcanic intrusives.

In the Cibola sub-area, three well defined mineralized areas are present: the Trigo mining district, the Silver and Eureka mining districts, and the Castle Dome mining district.

In the Trigo mining district, gold and manganese deposits are present. Gold occurs in the northern part of the district in quartz veins cutting Mesozoic schist which is intruded by Tertiary granite porphyry. Gold production has been small. Manganese occurs in the southern and eastern part of the district and occurs as psilomelane, pyrolusite, and manganite in pods, veins, and breccia fillings in fractured andesite and andesite porphyry. The ore contains 20 - 40% Mn and locally is enriched in Pb, Zn, and Cr. Ten to twenty thousand tons of ore were mined during the 1950s. Depth zonation is possible, with gold occurring in the stratigraphically lower Mesozoic schists and the manganese in the stratigraphically higher volcanics. The implication of this is that gold mineralization may underlie the Tertiary volcanics.

In the Silver and Eureka mining districts, silver- and lead-rich veins occur along shear zones and faults cutting Tertiary granite, andesite flows and tuff breccias, and Mesozoic schists. The districts are centered around Tertiary granitic intrusions. Production from the districts has been 1.6×10^6 oz. Ag, 1,400 tons Pb, 940 oz. Au, and 15 tons Zn. Cu, V, Ba, Sr, Mn, W, F, Mo, Bi, Cr, and Be are also locally present in anomalous concentrations. Important minerals present include galena, cerussite, smithsonite, calcite, malachite, anglesite, barite, celestite, cerargyrite, fluorite, vanadinite, quartz, hematite, pyrolusite, and wulfenite. This complex assemblage contains several sulfates, carbonates, and oxides suggesting deposition took place under oxidizing conditions and at a shallow depth (possibly supergene). It is possible that a more reducing sulfide-rich assemblage might be present at depth. The focus of the mineralization appears to be the Tertiary granitic intrusions, and it is probably in this area that potential for new discoveries is greatest.

In the Castle Dome mining district, silver- and lead-rich veins occur along shears in Mesozoic shales, slates, and limestones that are intruded by Tertiary diorite porphyry and rhyolite porphyry. Production from the district has been 450,000 oz. Ag and 1.7×10^6 pounds of Pb, with Cu, Zn, W, Mo, Au, As, Se, Sb, U, V, F, Ba, and Be also locally anomalous. Important minerals present include argentiferous galena and pyrite, cerussite, smithsonite, calcite, barite, anglesite, gypsum, vanadinite, fluorite, wulfenite, and uraninite. The presence of many sulfate and carbonate minerals suggests that conditions during deposition were oxidizing and at a shallow depth, possibly supergene. It is possible that a more reducing sulfide-rich assemblage may be present at depth.

In the Brenda sub-area, two mineralized areas that are probably related to mid-Tertiary volcanism are present: one, rather ill defined, in the central and north-central parts, and the other in the southernmost part of the Brenda sub-area.

In the central to north-central area, metals have been produced from lodes along faults cutting Tertiary volcanics and from lodes along steep faults and low-angle thrusts in Paleozoic and Mesozoic sediments and schists. Nearly 15,000 tons of ore was produced from this area -- the most important products being silver and copper, and of lesser importance lead, gold, and manganese. Other metals locally present in anomalous concentrations are Ba, Sr, V, Mo, and Be. Minerals present in this area include argentiferous galena, pyrargyrite, pyrite, cerussite, malachite, siderite, anglesite, hematite, pyrolusite, and psilomelane. Again, the presence of sulfate, oxide, and carbonate minerals suggests at least local oxidizing and shallow (supergene?) conditions of deposition. There is a wide zonation within the area with gold, silver, tungsten, and base metal occurrences being mainly in the central part of the Brenda sub-area and manganese, barium, and beryllium mainly in the north. This possibly suggests that temperatures were somewhat higher in the central part of the Brenda sub-area than they were in the northern part.

In the southernmost part of the Brenda sub-area, gold and minor copper occur in quartz veins and along shears cutting Tertiary andesitic tuffs and porphyries. There has been no production in this area.

In the Eagle Tail sub-area, gold, manganese, and lesser base metal mineralization associated with Tertiary volcanism occurs in five distinct areas, namely: west-central, southwest, northeast, east-central, and southeast.

In the west-central area, gold and silver with lesser amounts of Cu, Pb, Mn, Be, and Hg occur along faults in Tertiary flows and breccias of rhyolitic, dacitic, and andesitic composition. More minerals known to be present in the area include galena, pyrolusite, psilomelane, chrysocolla, and barite. Production from this has been 120,000 tons of ore.

In the southwestern area, gold and some copper are present in veins which crosscut Mesozoic schist which is intruded by Tertiary diorite porphyry dikes. There is no known production in the area.

In the northeastern area, Cu, Pb, and Zn in veins with some Au, Ag, and Ba occur along shears cutting Tertiary volcanics and a Laramide pluton. There is no known production in the area.

In the east-central area, manganese, gold, and locally base metal mineralization occurs in veins along faults in Mesozoic gneiss and schist, Tertiary volcanics, and Tertiary rhyolitic dikes. Approximately 100 tons of 20% Mn ore was mined from the area.

In the southeast area, gold, copper, molybdenum, and fluorite-bearing veins occur in Mesozoic schist which is intruded by Tertiary andesitic dikes. There is no known production from the area.

In the Saddle sub-area, veins that may be associated with mid-Tertiary volcanism are located in the west-central, east-central, and south-central portions of the sub-area. In the former two areas, Pb and Cu, and Bi and Ba, respectively, are found in Precambrian metamorphic rocks. In both areas, Tertiary volcanics are formed nearby, but it is not known for certain whether they are gentically related.

In the south-central part of the Saddle sub-area, a molybdenum-bearing quartz vein cuts Tertiary andesite some two miles from a Tertiary granitic intrusive. The mine produced 30 tons of 18% MoO_3. The chief minerals are wulfenite, ferrimolybdenite, and barite; and the vein also contains anomalous concentations of V, Cu, and Pb. The presence of oxide and sulfate minerals shows that mineral deposition took place under oxidizing, probably shallow (supergene?), conditions and sulfide ore may be present at depth.

Mid-Tertiary Basin-Fill Sediments

Mid-Tertiary valley-fill sediments are widespread in southwestern Arizona, and since the discovery of the Anderson Mine (Sherborne et al., 1979) have become a prime target for uranium exploration. The Anderson Mine is located 50 miles north of the Eagle Tail sub-area and has reserves of nearly 3 million pounds of U_3O_8, a figure in excess of previously quoted estimates for the entire Basin and Range Province (Sherborne et al., 1979).

In order to form a uranium deposit by the agency of circulating groundwater, or connate water, it is necessary to have adequate uranium source rocks, permeable sediments for the water to flow through, and a reductant to precipitate the uranium. Suitable source rocks are plentiful in southwestern Arizona and in the GRA. Their distribution is shown in Figure 2 (after Scarborough and Wilt, 1979) and they include Precambrian alkali and alkali-calcic granites, alkali-calcic Tertiary volcanics, and metamorphic core complexes which locally contain two-mica granites, uranium enriched detachment zones, and chloritic breccias (see previous section). Particularly good sources of uranium are potassium-rich igneous rocks (Keith and Reynolds, 1980) such as the potassic trachyandesites and ultra-potassic trachytes associated with later stages of the mid-Tertiary orogeny (Shafiqullah et al., 1980). In the Anderson Mine, the source of the uranium is postulated to be tuffaceous lake sediments from which connate water and uranium were squeezed out during compaction (Sherborne et al., 1979). Such tuffaceous lacustrine sediments are common in the mid-Tertiary sequence, especially in the middle and upper part of Unit I of Eberly and Stanley (1978). Permeable horizons suitable for transport of uranium, especially fluvial reddish sandstones and gravels, are plentiful within the Tertiary sequence. Reductants are also locally present. At the Anderson Mine, reductants are organic-rich mudstones (Sherborne et al., 1979). In the Plomosa and Gila Bend Mountains, they are fetid (organic?) limestones (Scarborough and Wilt, 1979). Another possible reductant are past and present geothermal waters, which even today are widely distributed in southwestern Arizona and within the GRA (see map of mineral deposits, Figure 3). If such geothermal waters are reducing, and geothermal waters generally are, then precipitation of uranium could occur at the interface between oxidizing groundwater and reducing geothermal water.

In the Kofa GRA, Tertiary sediments crop out in the northern part of the Brenda sub-area, in the central portion of the Eagle Tail sub-area, and in the southeastern area of the Saddle sub-area. They probably also underlie Late Tertiary sediments in the deeper basins shown in Figure 3. This has been shown to be the case in the southwestern and northeastern quarters of the Saddle sub-area by Eberly and Stanley (1978) on the basis of drillhole and seismic profiling data. Sediments are also extensively interbedded with units shown on the geologic map as Tertiary volcanics. This is demonstrated by Scarborough and Wilt's (1979) work which shows several detailed cross-sections through Tertiary volcanics, where it can be seen that the volcanic rocks are extensively interbedded with red fluvial sands and gravels and local lake beds. Such interbedding of volcanic rocks (U sources) with permeable red sediments allows for ready transport of uranium and thus enhances the favorability for uranium deposits. There is no known uranium production in the GRA.

In the Cibola sub-area, one uranium occurrence is present along the western margin of the Castle Dome Plain close to Tertiary rhyolitre exposures. It is not certain whether the occurrence is in mid- or late Tertiary sediments.

In the Brenda sub-area, three imprecisely located occurrences are reported on the east side of the Plomosa Mountains by Scarborough and Wilt (1979). One consists of a three-foot wide calcareous mudstone interlayered with fetid gray limestone. It shows X 9 background radioactivity and contains carnotite. The second is along a fault zone cutting red-brown fluvial conglomerate. It shows up to X 90 background radioactivity in the fault gouge. The third is a four-foot wide, chert nodule-rich gray limestone which shows a X 4 background radioactivity.

In the Eagle Tail sub-area, one undescribed uranium occurrence lies on the northeast edge of the Palomas Plain close to Tertiary volcanic exposures. It is not certain whether the occurrence is in mid- or late Tertiary sediments.

In the Saddle sub-area, a uranium occurrence is found in the western part of the Gila Bend Mountains. It occurs in 2- to 6-inch beds of fetid limestone interbedded with arkosic sands, and shows only X 2 background radioactivity.

Late Tertiary Basin-Fill Sediments

Late Tertiary sediments are present in all basins formed as a result of Basin and Range faulting. The depths of these basins are indicated by contours shown in Figure 3 and interpreted from gravity data by Oppenheimer and Sumner (1981). As in the case of the mid-Tertiary sediments, adequate uranium source rocks and permeable horizons are widespread. Extensive organic reductants are not known to be present in these sediments, but the widely occurring warm geothermal waters (see Figure 3) may be sufficiently reducing to cause uranium precipitation.

The two uranium occurrences in the Cibola and Eagle Tail sub-areas may be in late Tertiary sediments. Particularly favorable locations for the occurrence of deep-seated uranium mineralization in basins are in areas where deep basins coincide with low temperature geothermal areas. These are shown in Figure 3 and include the east-central portion of the Brenda sub-area; the northwestern and southeastern areas of the Eagle Tail sub-area; and the north-central, southwestern, and east-central parts of the Saddle sub-area.

Recent Alluvium

Alluvium formed in present day river valleys is a possible site for concentrations of placer gold and other heavy minerals.

In the Cibola sub-area, gold placer deposits occur along the Colorado River (1,160 oz.), in the Trigo mining district (less than 10,000 oz.), and in the Castle Dome mining district (about $115,000 worth). In the Brenda sub-area, about $35,000 worth of alluvial gold was produced in the Plomosa placers in the west-central part of the sub-area. In the Eagle Tail sub-area, an unknown amount of gold was produced from the Tank Mountain placers in the southwestern part of the sub-area. In the southeastern part of the Saddle sub-area, placer concentrations of samarskite and fergusonite are present.

Active Geothermal Systems

Extensive, but low temperature, geothermal resources are known to be present in southwestern Arizona (Jones, 1979). Factors that are favorable for the existence of substantial geothermal systems include: the presence of a high-termperature heat source, the presence of aquifers which allow large volumes of water to circulate through the hot rocks, and the presence of cap rocks which will prevent the escape to the surface of at least some of the hot fluid.

In southwestern Arizona, the intensity of volcanic activity has been waning during the past four million years. However, basalt flows as young as 1.3 m.y.B.P. are present (Shafiqullah et al., 1980). Aquifers and cap rocks, in the form of gravels and sands and lake beds, respectively, are present in the late Tertiary basin-fill sediments. These sediments occupy tectonic depressions resulting from Basin and Range faulting and many are over 5,000 feet deep. It is within these basins that warm geothermal fluids (>25°C) are present.

In the Kofa GRA, warm water is present in aquifers in the east-central part of the Brenda sub-area, in the northwestern and southeastern parts of the Eagle Tail sub-area, and in the north-central, southwestern, and east-central portions of the Saddle sub-area. The temperatures in these geothermal areas ranges from 32°C to 49°C. The waters could conceivably be used to enhance agricultural and aquacultural production (Jones, 1979).

Mineral Economics

The assessment of the geological, energy and mineral resources favorability should rely upon not only geology, but must also be concerned with economic factors and priorities. Discovery, recovery, cost of production of the resource from sources with varying qualities and/or concentrations are included in those considerations. Special consideration must be given to the strategic and critical minerals and metals. As this project is of limited scope, and because of special difficulties in southwestern Arizona, economic analyses of various commodities can only be discussed briefly.

Some factors especially important to the evaluation of the mineral and energy resources of southwestern Arizona include the following:

1. The geology of the Kofa GRA is very complex and detailed information on the geology and mineral deposits of the WSAs is, for the large part, lacking. This is multiplied by recent and ongoing reinterpretations of the geology of the Basin and Range in Arizona. In order to interpret the geology of the WSAs, and thus be able to project the types of mineral deposits that may be present in those areas, it is necessary to apply information about known areas of apparently similar geology to the interpretation of the geology of the WSAs. These are not optimum conditions. A wide variety of possibilities must be considered and, therefore, discussions of mineral economics must be considered as tentative.
2. Contributing to the problems listed above, and creating some other distinct difficulties, are the ruggedness and roadless nature of the WSAs. Roadlessness is a criterion for WSAs, while at the same time, it inhibits exploration and development of mineral resources due to poor access, distance to market, and other factors which increase the expense and difficulty of geological and mineral exploration.
3. A great number of commodities, including many strategic and critical minerals and metals, are known to occur in the WSAs and their surrounding areas (see Tables 7, 8, and 9).

4. Considering all the above mentioned problems, it is very possible that sophisticated methods currently used by professional geologic explorationists have not been fully employed in southwestern Arizona. Most of the mines and occurrences in the GRA were discovered many years ago by prospectors using simple techniques.

Much work must be done before a truly adequate evaluation of the mineral and energy resources, a prerequisite for the discussion of mineral and energy economics, can be made.

Commodities present in the Cibola sub-area and its enclosed WSAs are listed in Table 7. Due to the number of different commodities and occurrences present, only a brief account will be presented in the text. The South Trigo Mountains WSA (050-023A) contains occurrences of the non-strategic commodities gold (some mines record past production), molybdenum, and iron. Mines in the Trigo Mountains WSA (050-023B) have also produced gold, with occurrences of dumortierite, iron, and barite also known. No occurrences of non-strategic or strategic commodities are reported to exist in the Kofa Unit 3 Southern Addition WSA (050-031), Kofa Unit 4 Northern Addition WSA (050-033), or the Kofa Unit 4 Southern Addition WSA (050-034). The latter WSA is located less than two miles from a uranium occurrence (no. 64, Figure 3) and Kofa Unit 4 Northern Addition WSA (050-033) is less than two miles from a thermal well. In addition to the commodities reported to be in the WSAs, the following non-strategic commodities are reported elsewhere in the sub-area and could exist in the WSAs: zeolites, perlite, arsenic, and selenium.

Mines in the New Water Mountains WSA (020-125) of the Brenda sub-area have produced the non-strategic commodities gold and iron, with warm geothermal waters and building stone also occurring in the WSA (Table 8). Outside the WSA and very nearby, are the claims of the Ramsey mine, a past producer and recently under application for patented claims.

TABLE 7

LIST OF COMMODITIES PRESENT IN THE KOFA GRA CIBOLA SUB-AREA

	Location and number of occurrence as listed in previous section and production status: * = former producer						
	Wilderness Study Area						Strategic /Critical
Commodity	050-023A	050-023B	050-031	050-033	050-034	Outside WSA but in GRA sub-area	Commodity
iron	34	28				*1,26,29,32,40,43 52,56	
gold	*31	*243,2, 3,*7				*1,*7,*22,*40,*65, *68,*69,*70,*71,*75, *76,*78,*79,*80,4,5, 6,38,39,57,58,248	
zeolites						*240	
manganese	31,34, 35	*9,*10, *11,*12, *13,*14 *18,8,19 21,227				*16,*17,25,26,29,*60, 15,44,59,81	X
geothermal						63	
lead	*31,*34, *35,*36, *40,42	*243,27, 28,227				*16,*25,*26,*29,*32, *33,*41,*65,*67,*68, *69,*70,*71,*73,*74, *75,*76,*77,*78,*79, *82,30,37,43,44,45, 54,72,83	X
kyanite		20					
chromium		21				53	X
beryllium	42	24,46,227				68,70,78,30,44	X
silver	*31,*34, *35,*36	*243,27, 28				*25,*26,*29,*32,*33, *40,*41,*65,*67,*68, *69,*70,*71,*73,*74, *75,*76,*77,*78,*82, 5,30,37,38,39,43,44, 54,234,79,	X
mica						234	X

TABLE 7 (Continued)

LIST OF COMMODITIES PRESENT IN THE KOFA GRA CIBOLA SUB-AREA

	Location and number of occurrence as listed in previous section and production status: * = former producer						
	Wilderness Study Area					Outside WSA but	Strategic /Critical
Commodity	050-023A	050-023B	050-031	050-033	050-034	in GRA sub-area	Commodity
barite		227				25,*26,29,32,65, *68,69,*70,71,*78 82	
perlite						23	
uranium						67,47,48,64	
tungsten	31,35,51	28				32,67,44,52,83	X
vanadium	31,35, 42,49	*243,28				25,32,33,67,*68,70, 71,75,78,50	X
copper	*31					*1,25,33,*65,*68,*69 *70,71,*75,*79,82,38, 39,44,54,239	X
unidentified minerals						61,62	
zinc	31,35, *36,42	28,227				*16,26,29,*32,*33,*40 *68,*69,70,*77,78,79, 37,43,44,45,54,72	X
strontium						26,29,33,30	X
molybdenum	35	*243				32,33,*68,70,71,75,78 37	
fluorite	36					32,67,*68,69,*70,71,75 *78,*82,30,44,72	
bismuth	55	55				55	X
arsenic						68,70	X
selenium						68,70,78	

TABLE 7 (Continued)

LIST OF COMMODITIES PRESENT IN THE KOFA GRA CIBOLA SUB-AREA

	Location and number of occurrence as listed in previous section and production status: * = former producer						
	Wilderness Study Area						
Commodity	050-023A	050-023B	050-031	050-033	050-034	Outside WSA but in GRA sub-area	Strategic /Critical Commodity
antimony						68,70,78	X
tantalum						234	X
columbium/ biobium						234	X

TABLE 8

LIST OF COMMODITIES PRESENT IN THE KOFA GRA BRENDA AND EAGLE TAIL SUB-AREAS

	Location and number of occurrence as listed in previous section and production status: * = former producer							
	Brenda Sub-area		Eagle Tail Sub-area					Strategic /Critical
Commodity	In WSA 020-125	Outside WSA	In WSA 020-126A	In WSA 020-127	In WSA 020-128	In WSA 020-129	Outside WSA	Commodity
uranium		123,124, 245				183		
iron	*106, *118,111	113,*115 *131, *134,136, 93,94,95, 112,123, 130,132, 142,129, 244	165				*165,*220, *221,190	
barite		*115,124, 125,126, 127,133, 256,246						
copper	*106, *118, *242, 156	*98,*101, *105,*109, *113,*115, *119,*120, *122,*134, *136,*152, *158,*226, *249,*250, 92,93,110, 124,135, 156,251, 246			179, 180, 181, 182, 228, 229	*188, 189	*160,*167, *220,*221, 190,191,224	X
lead	*107, *109, *242,108	*101,*106, *113,*115, *119,*136, *247,137, 154,156		166	181,182	186,189,	*160	X
gypsum		139						
mercury			165				165	X

TABLE 8 (Continued)

LIST OF COMMODITIES PRESENT IN THE KOFA GRA BRENDA AND EAGLE TAIL SUB-AREAS

	Location and number of occurrence as listed in previous section and production status: * = former producer							
	Brenda Sub-area		Eagle Tail Sub-area					Strategic /Critical Commodity
Commodity	In WSA 020-125	Outside WSA	In WSA 020-126A	In WSA 020-127	In WSA 020-128	In WSA 020-129	Outside WSA	
manganese	116	*115, *119, *121, *145,94, 95,123, 124,142, 143,144, 146,147, 148,153, 246	165,	171,	*172, *175, 176,177		*160,*162, *165,161, 163	X
geothermal	155	155,252, 253				192	192,193	
tungsten		*103,*105, *151,104, 149,150						X
fluorite		256						X
gemstones		258						
sulfate		246						
gold	*96,*100, *106,*107 *109,157	*98,*99, *101,*105, *113,*115, *119,*120, *134,*136, *152,*158, *226,*247, *249,*250, 84,85,87, 88,89,90, 91,94,95, 97,110,124, 135,140, 156,255	165		*188, 174,178, 179,180, 181,182	185,189	*160,*165, *167,*168, *169,*170, *221,164, 190,224	

TABLE 8 (Continued)

LIST OF COMMODITIES PRESENT IN THE KOFA GRA BRENDA AND EAGLE TAIL SUB-AREAS

	Location and number of occurrence as listed in previous section and production status: * = former producer							
	Brenda Sub-area		Eagle Tail Sub-area					Strategic /Critical Commodity
Commodity	In WSA 020-125	Outside WSA	In WSA 020-126A	In WSA 020-127	In WSA 020-128	In WSA 020-129	Outside WSA	
silver	*100,*106 *107,*109 *118,*242 157	*98,*99, *119,*113, *120,*122, *134,*136, *152,*158, *226,*247, *250,110, 124,135, 246,*103,	*165		179,181	189	*160,*165, *221,223,224	X
zinc	*106,	*115,*136			180, 181,182	189		X
strontium		*115						X
vanadium		*115						X
asbestos					173			X
molybdenum		*115				187		
beryllium		*121,*128, 138					161	X
fluorite		128,256				184		
gemstones		*141						
unidentified minerals		86,102, 117,159						
building stone	114							
hematite		244						

In the Eagle Tail sub-area (Table 8), claims included in the Davis Prospect (165, a past producer) extend into the Little Horn Mountains West WSA (020-126A). The deposit has produced gold and also contains iron mineralization. Other mineral occurrences and the Sheep Tanks Mine, a past producer of gold and strategic commodities, are located close to the WSA. No production is recorded from prospects in the Little Horn Mountains East WSA (020-127), although two occurrences of strategic commodities are noted. Gold was produced in the Eagle Tail Mountains (020-128) and Clanton Well (020-129) WSAs. Other occurrences of the non-strategic commodities discussed in this paragraph are located in the sub-area, some within a few miles of WSA boundaries.

No reported mineral occurrences are located in the Signal Mountain (020-138) WSA of the Saddle sub-area (Table 9). Gold was produced from the Face Mountain WSA (020-136). Uranium, thorium, and yttrium occur within the Woolsey Peak WSA (020-142/144). Outside the WSAs, but within the Saddle sub-area, are occurrences of perlite, barite, molybdenum, pumice, and warm geothermal waters.

There has been much recent speculation about the potential for oil and gas occurrences in the Basin and Range of southern Arizona. It has been suggested that the Overthrust Belt, related to oil occurrences from Canada to Utah, extends into Arizona as a wide NW-SE trending belt curling around the Colorado Plateau in the Basin and Range area (Peirce, 1982; Anschutz, 1980). The theory states that around 60 m.y.B.P. older crystalline rocks, such as those that crop out in the Eagle Tail and Saddle sub-areas, were thrust over younger, possibly oil-rich, strata (Peirce, 19820. The complex structures, including Basin and Range faults, found in southern Arizona coupled with the high temperatures created by igneous activity since that time dim the possibility of preservation of oil and gas. Peirce (1982) states

TABLE 9

LIST OF COMMODITIES PRESENT IN THE KOFA GRA SADDLE SUB-AREA

Commodity	Location and number of occurrence as listed in previous section and production status: * = former producer				Strategic /Critical Commodity
	Wilderness Study Area			Outside WSA but in GRA sub-area	
	020-136	020-138	020-142/144		
geothermal				194,200,217,219	
uranium			213,214	*235,215,218	
lead	197,		214,	*202,198,204,215	×
unidentified minerals	195,196		216	201,203,208	
copper	*231			*202,*232,199,206, 207,238	×
crushed stone				205	
molybdenum				*202	
gold	*231			*230,*232,238,*225	
barite				*202,*232,210	
perlite				211,241	
vanadium				*202,	×
sulfide				238	
pumice				236,237	
niobium/ columbium			214	*235,112,215	×
silver	*231		219	*230,238	×
manganese				*232	×
silicon				*232?, *235?	
sulfide				*232?	
gemstones				*235	

TABLE 9 (Continued)

LIST OF COMMODITIES PRESENT IN THE KOFA GRA SADDLE SUB-AREA

Commodity	Location and number of occurrence as listed in previous section and production status: * = former producer				Strategic /Critical Commodity
	Wilderness Study Area			Outside WSA but in GRA sub-area	
	020-136	020-138	020-142/144		
iron				*235	
mica				*235	×
feldspar				*235?	
bismuth				209	×
thorium			214	215	
titanium			214	215	×
tantalum			214	215	×
yttrium			214	215	

if the Overthrust Belt exists, or ever has existed, in Arizona, geologic complexity obscures it and drilling has not yet resolved the issue. Anschutz (1980) suggests that the Overthrust Belt could become the most important oil and gas province to be discovered in the last 20 to 30 years, but also states that it is one of the most difficult and expensive areas to explore and develop.

WSAs of the Eagle Tail and Saddle sub-areas are largely covered by oil and gas leases. Leased land is located close to the WSAs in the Brenda and Cibola sub-areas and extends into parts of the New Water Mountains (020-125) and Trigo Mountains (050-023B) WSAs.

Strategic and Critical Minerals and Metals

Within the Kofa GRA are numerous occurrences of many strategic and critical minerals and metals. Please consult Tables 7, 8, and 9 for a complete listing of all occurrences within the WSAs and the GRA.

Mines in the South Trigo Mountains WSA (050-023A) of the Cibola sub-area have produced the strategic and critical metals lead, silver, and zinc. Occurrences of manganese, beryllium, tungsten, vanadium, copper, and bismuth located within the WSA have no reported production. The Trigo Mountains WSA (050-023B) contains deposits that have produced manganese, lead, silver, and possibly vanadium and occurrences of chromium, beryllium, tungsten, zinc, and bismuth that have not produced. Many deposits in the Silver, Eureka, and Trigo mining districts (see Figure 3) have produced strategic and critical minerals and metals and/or contain occurrences that have not produced. Commodities not previously mentioned are mica, strontium, antimony, tantalum, and niobium (columbium).

Copper, lead, silver, and zinc, all strategic metals, have been produced from mines in the New Water Mountains WSA (020-125) of the Brenda sub-area. Occurrences of manganese within the WSA have not produced. Tungsten deposits located less than a mile outside the southwest corner of the WSA are past producers. Copper, silver, lead, and manganese occurs in the Ramsey mine (115), a past producer located along the northern boundary of the WSA. Other strategic and critical minerals and metals occurring within the Brenda sub-area are fluorite, strontium, vanadium, and beryllium.

The Davis prospect, which extends into the Little Horn Mountains West WSA (020-126A) of the Eagle Tail sub-area, has produced silver and also contains manganese and mercury. Lead and manganese occur in the Little Horn Mountains East WSA (020-127). Manganese has been produced from mines located within the Eagle Tail Mountains WSA (020-128), and copper, lead, silver, zinc, and amphibole asbestos also occur. The Clanton Well WSA (020-129) encompasses a deposit that has produced copper as well as non-producing occurrences of lead, silver, and zinc. A beryllium occurrence is located outside the WSAs but within the sub-area.

No occurrences are reported for the Signal Mountain WSA (020-138). Copper and silver have been produced from mines in the Face Mountain WSA (020-136) with lead also reported to occur. There has been no known production of strategic and critical commodities within the Woolsey Peak WSA (020-142/144), but lead, niobium, silver, titanium, and tantalum do occur. Vanadium, manganese, and bismuth also occur within the sub-area.

Silver, lead, and zinc are the strategic commodities with greatest production from the WSAs and adjoining parts of the sub-areas. Zinc has a variety of industrial applications, the most important being zinc-base alloy die castings, galvanizing iron and steel products, and brass production. Much of the lead used in the United States is consumed in the manufacture of storage batteries and as a gasoline additive, although use in gasoline is not as important as it once was. Use in ammunition and solder is also important, increasingly so during wartime. More silver is consumed in photography in the United States in one year than this country produces during that time (Brobst and Pratt, 1973).

Niobium and tantalum have become more important as our technology advances, with metallurgical, electronic, chemical and nuclear uses. Although abundant elsewhere in the world, manganese, critical to the steel industry and also used in the chemical industry, is virtually absent in the United States. The same is true about tungsten, which in addition to steel and chemicals, also enjoys use in non-ferrous alloys and as tungsten carbide. Copper, although considered a strategic and critical metal, occurs in abundance in Arizona. Sheet mica still enjoys use in electronics and other industries. Chromium and vanadium both occur rarely in the United States and are very important in the steel industry. Beryllium is used in alloys due to its strength and low density and in ceramics. Most bismuth is used in pharmaceuticals, with alloys, metallurgy and cosmetics also consuming the metal. Fluorite is used as a flux in steel manufacture, with fluorine used also in aluminum smelting, refrigerants, solvents, and aerosol propellants.

Chrysotile asbestos is much used, but actinolite asbestos present in the GRA is often of low quality. An important catalyst in chlorine gas and caustic soda production, mercury is also used in electrical apparatus and as a pesticide. Titanium is used mainly in the aerospace and chemical industries, but also is consumed as pigments and nonreactive coatings. The largest domestic use of antimony is in the manufacture of storage batteries.

In summary, it must be noted that the Kofa GRA contains a large number of mineral occurrences and many different commodities. Many deposits of strategic and critical commodities, several of which have produced, are known to occur in the WSAs and surrounding parts of the sub-areas. Further exploration could lead to the discovery of potentially important deposits in the GRA and WSAs.

THE GEOLOGY, ENERGY AND MINERAL RESOURCES OF THE WILDERNESS STUDY AREAS

In this section, each individual WSA is discussed with respect to its physiography, geology, mineral occurrences, resource potential, and recommendations for further work. For most of the WSAs, detailed and specific information is lacking; in these cases, information pertinent to the particular WSA will be summarized from the preceding sections. The classification of resource potential and level of confidence is according to the scheme provided by the Bureau of Land Management (attachment 9, dated March 24, 1982). The classification is summarized on the maps in Figures 13 through 14 and detailed below.

Classification Scheme

1. The geologic environment and the inferred geologic processes do not indicate favorability for accumulation of mineral resources.
2. The geologic environment and the inferred geologic processes indicate low favorability for accumulation of mineral resources.
3. The geologic environment, the inferred geologic processes, and the reported mineral occurrences indicate moderate favorability for accumulation of mineral resources.
4. The geologic environment, the inferred geologic processes, the reported mineral occurrences, and the known mines or deposits indicate high favorability for accumulation of mineral resources.

Level of Confidence Scheme

A. The available data are either insufficient and/or cannot be considered as direct evidence to support or refute the possible existence of mineral resources within the respective area.

B. The available data provide indirect evidence to support or refute the possible existence of mineral resources.

C. The available data provide direct evidence but are quantitatively minimal to support or refute the possible existence of mineral resources.

D. The available data provide abundant direct and indirect evidence to support or refute the possible existence of mineral resources.

Trigo Mountains and South Trigo Mountain WSAs (050-023B and 050-023A)

The WSAs lie within the Trigo Mountains, between the Colorado River and the Yuma military proving ground. The mountains trend north-south and have a relief of about 1,000 feet (Figure 3).

Geology

The WSAs are underlain by Mesozoic metamorphic rocks, mid-Tertiary volcanics and intrusives, and late Tertiary marine and fluvial sediments. The Mesozoic rocks may consist of mid-Mesozoic volcanic and volcanoclastic rocks and mainly fluvial conglomerates, sandstones and siltstones. The Mesozoic rocks have been metamorphosed to schists prior to the Laramide orogeny. The mid-Tertiary rocks are andesitic in composition and consist of flows and breccias. Tertiary intrusives occur mainly in the south and central parts of the WSAs, are granitic and andesitic in composition, and include andesite and granite porphyries. Late Tertiary marine sediments of the Bouse Formation crop out in the northwest corner of the WSAs and consist of basal limestone overlain by bentonitic claystone, silt, and fine-grained sand. The Bouse Formation is overlain by younger alluvial sediments deposited by the Colorado River.

Mineral Deposits

Three mining districts overlap onto the WSAs: the Trigo mining district in the north and the Silver and Eureka mining districts in the south. The mineralization in both is related to mid-Tertiary igneous activity.

In the Trigo mining district, gold-bearing quartz veins occur in Mesozoic schist which is intruded by granite porphyry. Two of these quartz veins are within the WSA, but neither has any reported production. The Trigo gold placers, with a reported production of less than 10,000 oz. Au, overlaps the northern part of the WSAs. The southern part of the district is dominated by manganese mineralization which occurs along fractures in andesitic volcanics. The ore is locally enriched in Pb, Zn, and Cr. Eleven occurrences are within the WSA and approximately 25,000 tons of 20 to 40% Mn ore was mined in the 1950s. The occurrence of gold in the stratigraphically lower schists and manganese in the overlying volcanics suggests that gold mineralization may underlie volcanics at greater depth.

In the Silver and Eureka mining districts, silver- and lead-rich veins occur in Mesozoic schists and Tertiary andesites and intrusives. The focus of hydrothermal activity appears to be the granitic intrusives at the southern end of the WSAs. In addition to silver and lead, Au, Zn, Cu, V, Ba, Sr, Mn, W, F, Mo, Bi, Cr, and Be are locally present in anomalous concentrations. The mineralogy is indicative of highly oxidizing conditions during mineral deposition (possibly supergene), and it is possible that sulfide-rich assemblages may be present at depth. Four occurrences are present within WSA 050-023B with Be, Ag, and Ba, but there is no recorded production. WSA 050-023A contains two of the major silver producers for the district, three other Ag occurrences, and one occurrence each of W and V. Exploration is ongoing in the old Papago and Geronimo Mines and their surrounding areas and in the MP claims. The New Jersey Zinc Company has delineated mineable ore reserves.

A single dumortierite occurrence of possible gem quality occurs near the center of the WSAs. There is no recorded production.

Land Classification for GEM Resources Potential

Metallic Minerals - The northern part of the WSAs that coincides with the Trigo mining district (Area 1) is classified as highly favorable for the occurrence of metallic minerals, particularly manganese and gold, at a confidence level of C (Figure 13). The reasons for the above classification are as follows:

a) Recorded past production of manganese -- a strategic and critical metal.

b) The geological possibility that gold mineralization occurs in the schists underlying the volcanics.

c) The production of placer gold.

d) The occurrence of chromium in the district -- another strategic and critical metal.

The southern part of the WSAs that coincides with the Silver and Eureka mining districts (Area 2) is classified as highly favorable for the occurrence of metallic minerals, particularly silver and lead, at a confidence level of C. The reasons are as follows:

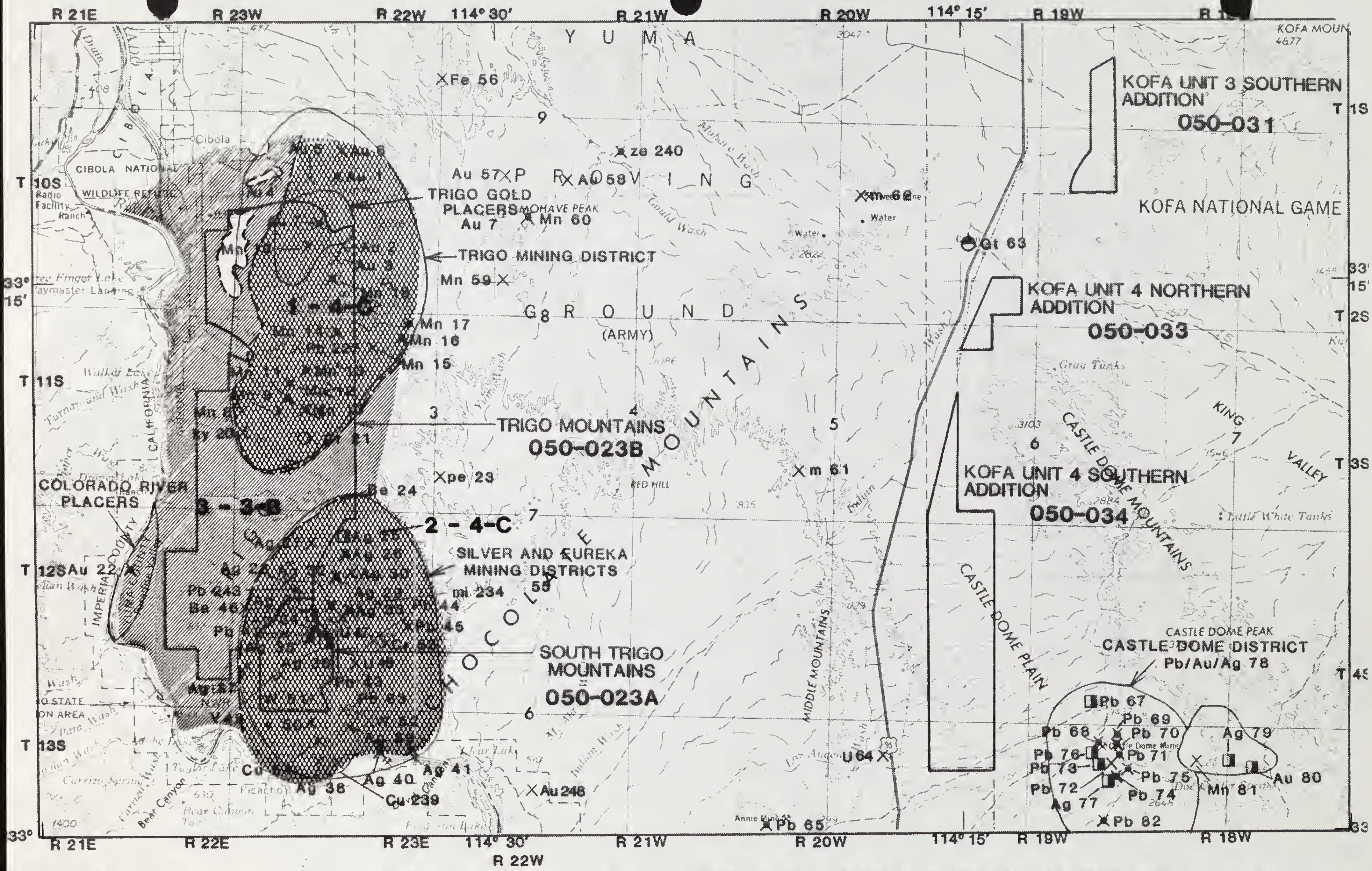


FIG.13 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR METALLIC MINERAL RESOURCES OF THE CIBOLA SUB-AREA, ARIZONA.

a) Recorded past production of Pb and Ag in mines immediately adjacent to the WSAs, for instance, the Silver Clip and Red Cloud Mines.

b) The presence of four occurrences of Ag, Ba, and Be in the WSA.

c) The presence of Tertiary granites which may have been loci for hydrothermal activity.

d) The occurrence of anomalous concentrations of Be, Bi, F, Mn, Sr, W, and Zn, which are strategic and critical minerals.

e) The presence of common supergene minerals in most mines suggests sulfide mineralization may be present at depth.

The remainder of the WSAs and their surroundings that are underlain by Mesozoic schist, Tertiary igneous rocks, and more recent sediments (Area 3) is classified as moderately favorable for the occurrence of metallic minerals at a confidence level of B for the following reasons:

a) Production of metallic minerals has occurred nearby.

b) The geology of this area is similar to the nearby areas where production has taken place.

Uranium - The northwest corner of the WSAs, which is underlain by late Tertiary sediments (Area 4) is considered to be of low favorability for the occurrence of uranium at a confidence level of B (Figure 14) for the following reasons:

a) No uranium occurrences are known in the area.

b) The area is underlain by a thick sequence of late Tertiary and possibly mid-Tertiary sediments where suitable source rocks, aquifers, and reductants may be present.

Non-Metallic Minerals - The area surrounding the dumortierite occurrence (Area 5) is classified as moderately favorable at a confidence level of B

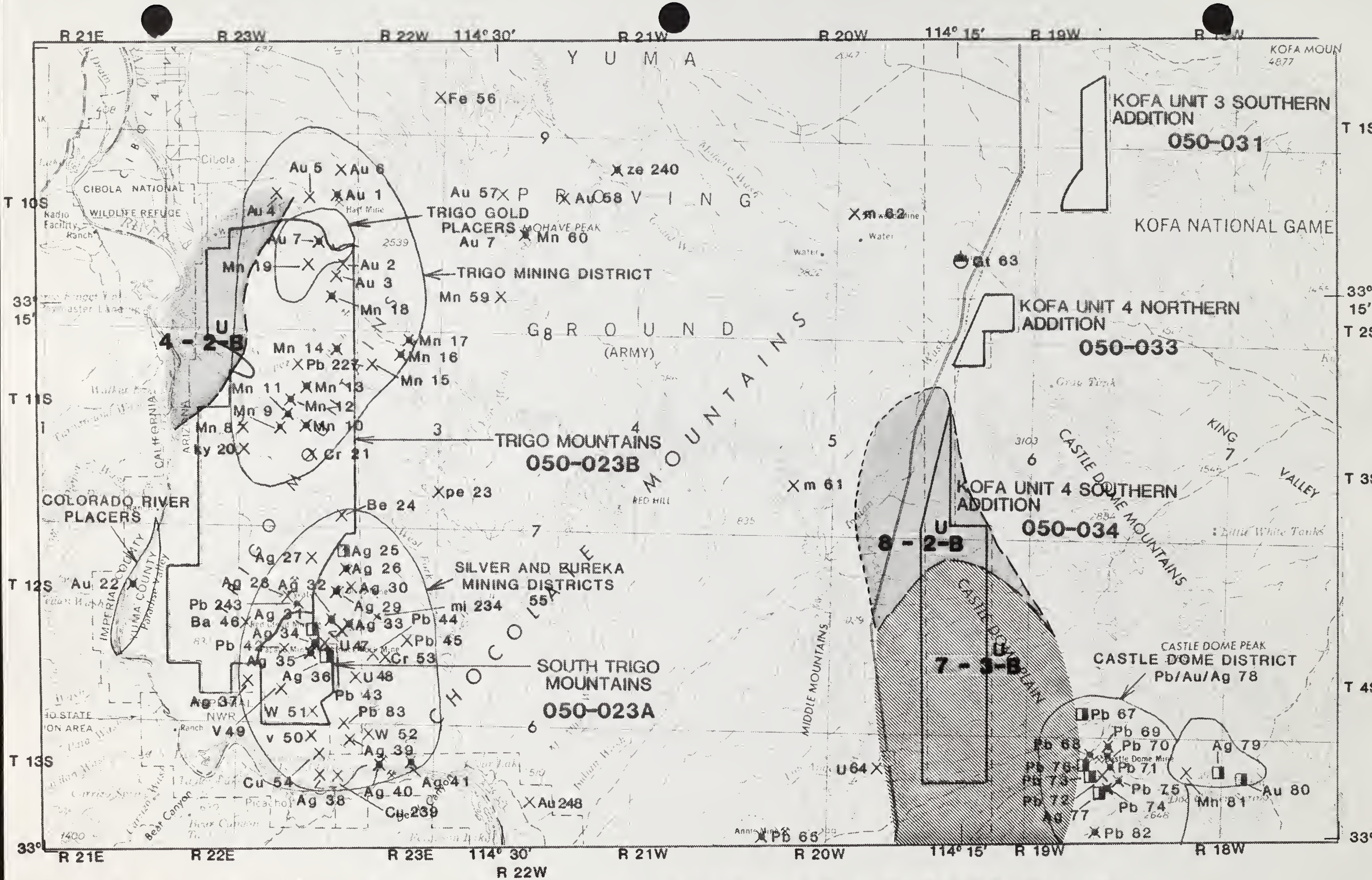


FIG.14 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR URANIUM RESOURCES OF THE CIBOLA SUB-AREA, ARIZONA.

because the occurrence contains dumortierite of possible gem quality.

The Bouse Formation outcrop (Area 6) is classified as having a low favorability for the occurrence of bentonite at a confidence level of B because of the reported presence of swelling clays in the Bouse Formation.

Recommendations

For Area 1, it is recommended that:

a) The area be field checked to establish whether zonation between gold at depth and manganese closer to the surface is present in the district.

b) Intrusive dikes and hydrothermal alteration should be dated to check for genetic relationship between igneous and hydrothermal events.

c) If such a relationship is established, then detailed field mapping should be carried out to check for the presence of, and determine relationship to, intrusive centers and/or cauldrons.

For Area 2, it is recommended that:

a) The area be field checked to establish whether oxide-carbonate-sulfate mineral assemblage is supergene. If it is, sulfide ore at depth may be expected.

b) The granitic stocks and hydrothermal alteration should be dated to establish genetic relationship between igenous intrusion and mineralization.

c) The district should be field checked to determine whether there is any district-wide hydrothermal mineral zonation. Such a zonation may project to the locus of hydrothermal activity and location of large disseminated deposits.

d) The area should be field checked for possible presence of cauldrons

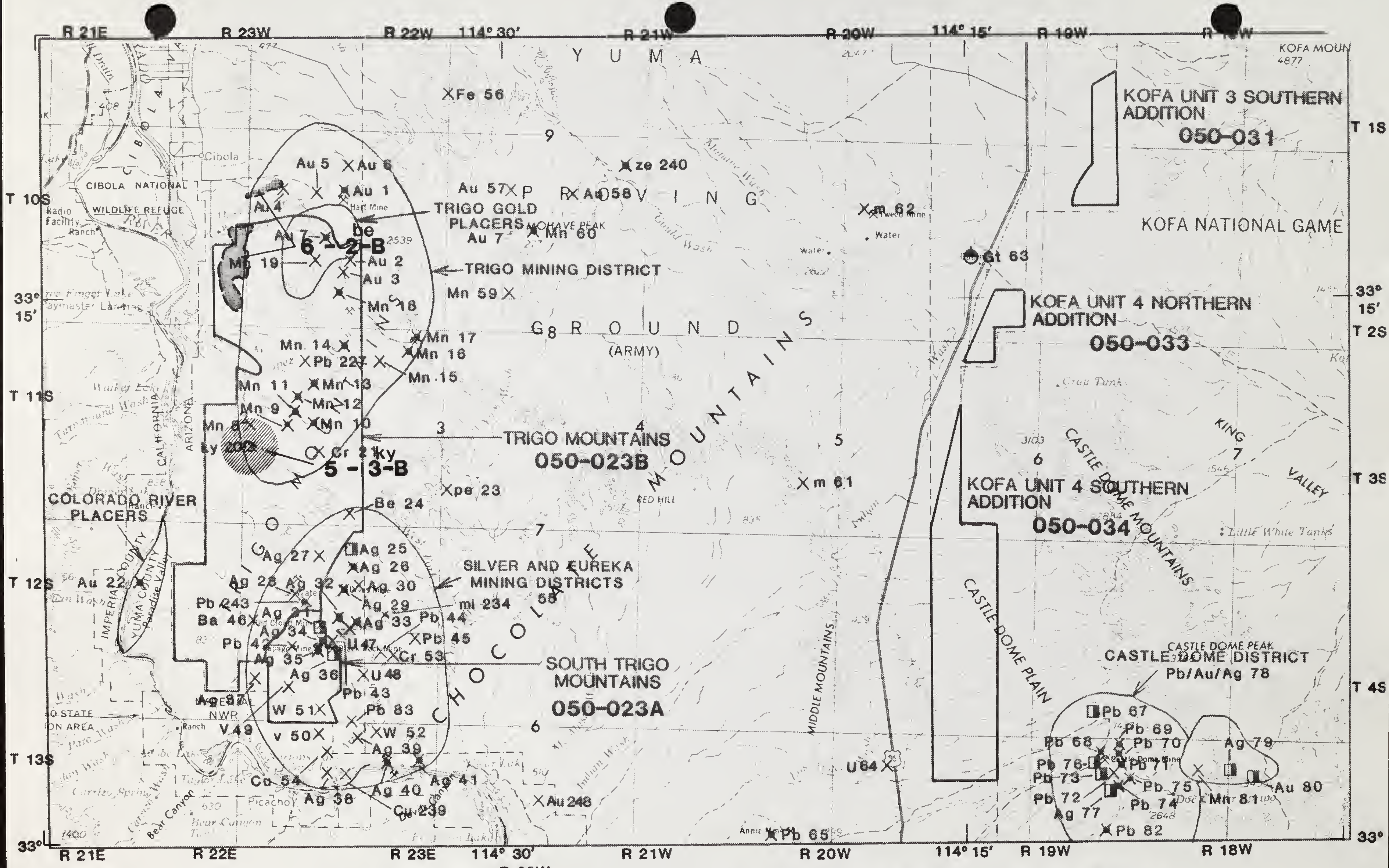


FIG.15 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR NON-METALLIC MINERAL RESOURCES OF THE CIBOLA SUB-AREA, ARIZONA.

and their relationship to mineralization.

For Area 3, it is recommended that the vicinity of the Tertiary intrusive near the center of the WSAs be field checked for the presence of extensive hydrothermal alteration and disseminated mineralization.

For Area 4, it is recommended that:

a) The area be field checked for the presence of uranium source rocks, aquifers, and suitable reductants.

b) Available wells should be sampled and analyzed for uranium, fluoride, phosphate, carbonate, calcium, potassium, vanadium, Eh, and pH, and the solubility index calculated for each sample.

For Area 5, it is recommended that the dumortierite occurrence be checked to determine whether gem quality stones are indeed present in the area.

For Area 6, it is recommended that:

a) The area be field checked for the presence of expansible clays.

b) The nature and quality of the clays should be checked by X-ray diffraction and other laboratory techniques necessitated by the results of X-ray diffraction.

Kofa Unit 4, Southern Addition WSA (050-034)

Physiography

The WSA is in the Castle Dome Plain which lies between the Castle Dome Mountains to the east and the Middle Mountains to the west. The Castle Dome Plain is a north-south-trending tectonic depression caused by Basin and Range deformation. The WSA lies on a gently, westward-sloping surface which drains the Castle Dome Mountains (Figure 3).

Geology

The WSA is underlain by Tertiary rocks which vary in thickness from less than 400 feet in the north to more than 3,200 feet in the south. The Tertiary rocks are not known to crop out within the WSA, but they probably consist of late Tertiary basin-fill sediments and mid-Tertiary volcanics and fluvial and lacustrine sediments. Tertiary andesites and rhyolites crop out to the west of the WSA, and undifferentiated volcanics crop out to the east.

Mineral Deposits

There are no known mineral deposits within the WSA, but one uranium occurrence (64) is located in basin-fill sediments about two miles west of the southern end of the WSA. There is no known production from this occurrence.

Land Classification for GEM Resources Potential

Uranium - The southern part of this WSA (Area 7) is classified as having moderate favorability for uranium at a confidence level of B (Figure 14). The reasons for the above classification are as follows:

a) A uranium occurrence is located within the same basin close to the WSA.

b) The basin is deep locally over 3,200 feet.

c) Rhyolitic volcanic rocks, which are possible source rocks for uranium, crop out to the west of the WSA.

The northern part of the WSA (Area 8) is classified as having a low favorability for uranium at a confidence level of B. The reasons for the above classification are:

a) Tertiary sediments and possibly volcanics underlie this part of the WSA, but

b) The Tertiary rocks are less than 400 feet thick.

c) There are no nearby uranium occurrences.

Recommendations

For both Areas 7 and 8, it is recommended that:

a) The areas be field checked for presence of uranium source rocks, aquifers and reductants.

b) Available water wells should be sampled and analyzed for uranium, fluoride, phosphate, carbonate, calcium, potassium, vanadium, Eh and pH, and the solubility index calculated for all well water samples.

Kofa Unit 4, Northern Addition WSA (050-033)

Physiography

The WSA lies near the northern end of the Castle Dome Mountains along the divide between the La Posa and Castle Dome Plains. The topography is hilly and the relief is about 500 feet (Figure 3).

Geology

The area is underlain by mid-Tertiary rhyolites and andesites. The rhyolite rocks may consist of flows, ignimbrites, tuffs, and the andesitic rocks of flows and breccias.

Mineral Deposits

There are no known mineral deposits within the WSA.

Land Classification for GEM Resources Potential

The WSA is classified as not favorable for the occurrence of mineral resources because of the absence of any evidence for the presence of mineral deposits. The level of confidence is B because very little is known about the geology of this area.

Recommendations

The area should be field checked for evidence of hydrothermal alteration that would indicate possible presence of mineralization.

Kofa Unit 3, Southern Addition WSA (050-031)

Physiography

The WSA lies near the southern end of the La Posa Plain at the northern extremity of the Castle Dome Mountains and on the western flank of the Kofa Mountains. The area is hilly and has a maximum relief of about 1,000 feet. Drainage is to the west into the La Posa Plain (Figure 3).

Geology

The WSA is underlain by Tertiary basalts, undifferentiated volcanics, and minor andesites and rhyolites. The basaltic rocks are probably mainly flows; the andesitic rocks are flows and breccias; and the rhyolitic rocks are flows, ignimbrites, and tuffs.

Mineral Deposits

There are no known mineral deposits within the WSA.

Land Classification for GEM Resources Potential

The WSA is classified as not favorable for the occurrence of mineral resources because of the absence of any evidence for the presence of mineral deposits. The level of confidence is B since very little is known about the geology of this area.

Recommendations

The area should be checked in field for determination of the rock types, any types of structural features, alteration, and mineralization. If any evidence of mineralization is found, at least preliminary geochemical sampling should also be considered.

New Water Mountains WSA (020-125)

Physiography

The WSA lies at the southern end of the Plomosa Mountains; it includes the northern part of the New Water Mountains, and in the northeast, extends into the Ranegras Plain. In the west-central part of the WSA, the region is mountainous with steep slopes and a relief of nearly 1,500 feet. In the northeast, the Ranegras Plain slopes gently northeastward. The southwest margin of the Ranegras Plain ends abruptly as a steep escarpment that is nearly 1,500 feet high. Elsewhere, the topography is hilly with relief generally less than 800 feet (Figure 4).

Geology

The geology of the New Water Mountains WSA is highly complex -- more complex than any other WSA within the Kofa GRA. Precambrian, Paleozoic, Mesozoic, mid-Tertiary, and late Tertiary rocks are present within the WSA, and the area has been affected by at least the Mesozoic and mid-Tertiary orogenies.

The Precambrian granitic rocks are probably part of the anorogenic alkali to alkali-calcic granitic to quartz dioritic intrusive series emplaced 1.5 to 1.3 b.y.B.P. To the west of the WSA, they consist of quartz monzonites; but their composition within the WSA is not known.

Paleozoic rocks have been differentiated into formations but probably include quartzites, dolomites, limestones, and minor mudstones. Basal Mesozoic rocks include dacitic to rhyolitic flows, ash-flow tuffs, and tuffaceous sediments. These comprise part of the Jurassic magmatic arc with which the porphyry copper deposit at Bisbee is associated. The volcanic rocks are overlain by nearly 10,000 feet of fluvial conglomerates, sandstones and siltstones in which the basal portion are red beds that contain lacustrine mudstones, limestone, and gypsum deposited in a playa environment.

No Laramide intrusive or volcanic rocks are known to be present in the area; and the above mentioned basement rocks are overlain by mid-Tertiary rhyolitic, andesitic, and basaltic volcanics. The basalts consist mainly of flows; the andesites of flows and breccias; and the rhyolitic rocks of flows, ignimbrites, and various tuffs. No Tertiary intrusive centers or cauldrons have been identified in the area.

The Ranegras basin was formed during Basin and Range faulting and is filled with up to 1,600 feet of valley-fill sediments.

Mineral Deposits

Mineral deposits in the New Water Mountains WSA occur in two distinct geological environments. The first is close to the intrusive contact of a mid-Mesozoic granitic pluton in the western part of the WSA. The second is within Tertiary volcanic rocks scattered over much of the WSA.

The deposits that are spacially associated with the intrusive include the following:

a) A copper-silver deposit (106) that occurs along thrust faults in Paleozoic limestone and Mesozoic red beds. A total of 2,100 tons of 11% Cu and 12 oz. Ag ore were produced from this mine.

b) A gold-bearing quartz vein (100) in Paleozoic sediments with production of 100 tons containing 3.8 oz. Au per ton.

c) A lead, copper, and gold (109) replacement deposit in Paleozoic limestone with production of 130 tons of 3% Cu and 1 oz. Au per ton.

d) Two iron prospects (111, 112) near the southern margin of the intrusion.

The spacial association of these deposits with the mid-Mesozoic intrusive suggests the possibility that they are genetically related.

The remaining mineral occurrences in this WSA are located within Tertiary volcanic rocks and are probably associated with the mid-Tertiary magmatism. The largest deposit, the Ramsey Mine (115), is close to the boundary of the WSA and is a silver-lead mine with anomalous concentrations of Zn, Ca, Ba, Sr, V, Mn, Fe, and Mo. The ore is in a vein within a brecciated zone in Tertiary rhyolite. 8,400 tons of 35 oz. Ag per ton and 1% Pb ore were produced between 1921 and 1969. Copper-silver deposits in the Moore Mine Group (118) occur in small, high-grade chimneys (breccia pipes?) in altered porphyritic andesite. 480 tons of 3.7% Cu and 1 oz. Ag per ton were produced in the 1940s from oxidized ore. In addition, lead (108) and silver (157) prospects with no recorded production occur in Tertiary volcanic rocks.

Land Classification for GEM Resources Potential

The WSA is potentially favorable for the occurrence of metallic minerals, uranium, and geothermal energy.

Metallic Minerals - The west-central part of the WSA, centered on the Mesozoic intrusive (Area 9) is considered moderately favorable for the occurrence of metallic minerals at a confidence level of B (Figure 16). The reasons for this classification are as follows:

a) Mid-Mesozoic plutons in southern Arizona have been considered favorable for the occurrence of porphyry copper deposits.

b) Several small copper, gold, silver, lead, and iron mines and occurrences are located near the intrusive contact of the pluton.

The area underlain by Mesozoic sediments (Area 10) are classified as having low favorability for red-bed-type copper-silver deposits, at a confidence level of B. The reasons for this classification are as follows:

a) The Mesozoic sediments contain permeable red beds with some interstratified evaporites, however,

b) There are no known stratabound, red-bed-type occurrences in the WSA.

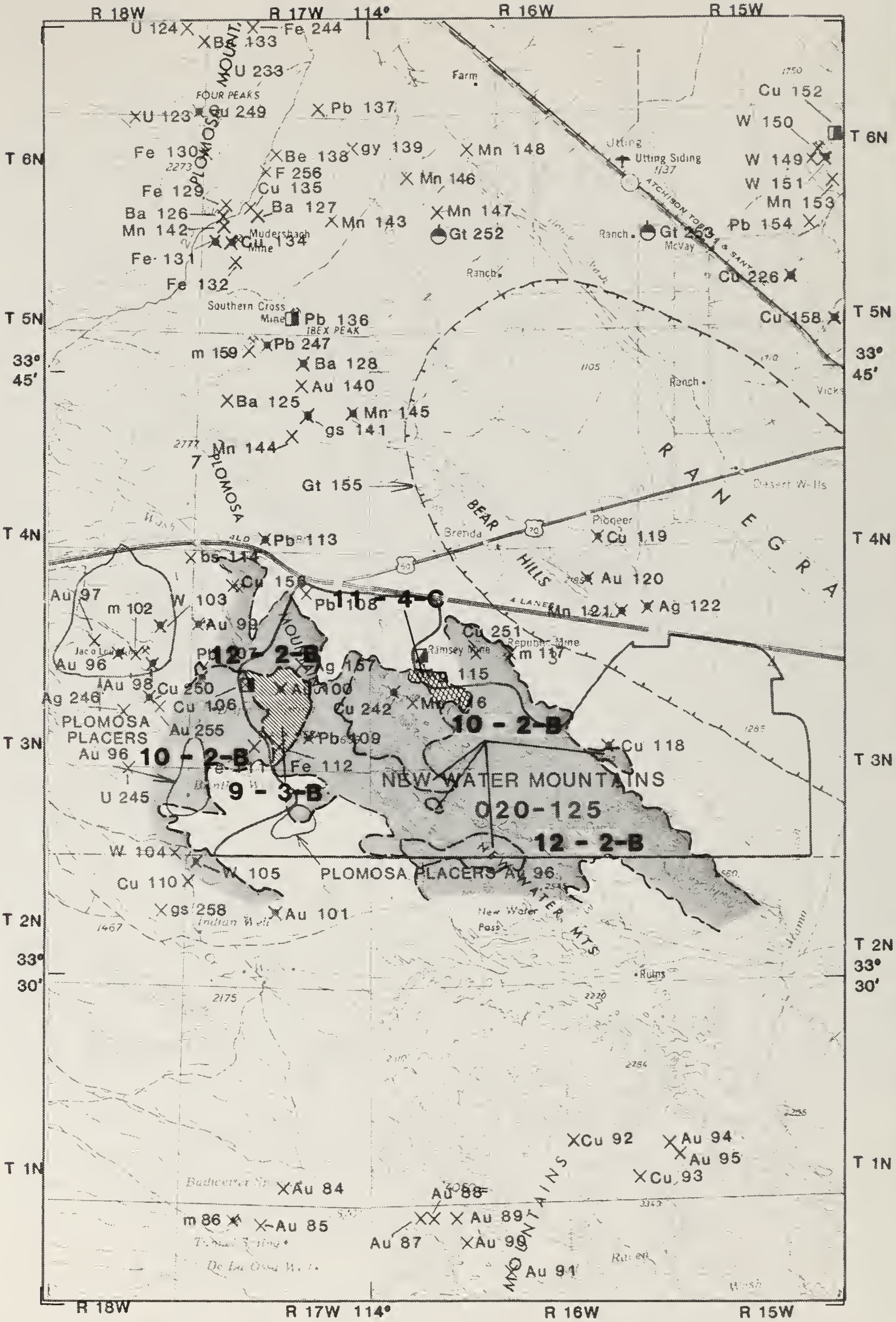


FIG.16 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR METALLIC MINERAL RESOURCES OF THE BRENDA SUB-AREA, ARIZONA.

The area underlain by Tertiary volcanics near the Ramsey Mine (Area 11) is considered highly favorable for metallic mineral deposits at a level of confidence of C because the Ramsey mine produced 8,400 tons of ore containing 35 oz. Ag per ton.

The remainder of the WSA underlain by Tertiary volcanics (Area 12) is considered to have a low favorability at a confidence level of B because only three occurrences are present over this entire area: two (108, 157) with no recorded production, and one (118) with very small (480 tons) production.

Uranium - The eastern part of the WSA (Area 13) is considered to have low favorability for occurrence of uranium deposits at a confidence level of B (Figure 17). The reasons for this classification are as follows:

a) There are no uranium occurrences in or near the area, however,

b) There is a thick sequence (over 1,600 feet in the northeast) of late Tertiary basin-fill sediments and possibly mid-Tertiary volcanics and sediments underlying the area.

c) Rhyolitic volcanic rocks, which are possible source rocks for uranium, crop out southwest of the area and may be interbedded within the basin.

d) Low-temperature geothermal water, which could act as a reductant for uranium, underlie the area (see below).

Geothermal - The northeastern part of the WSA (Area 14) is classified as having low favorability for geothermal energy at a confidence level of B (Figure 18) for the following reasons:

a) There is chemical evidence for the occurrence of warm water at depth, but

b) There are no warm springs or wells in the area.

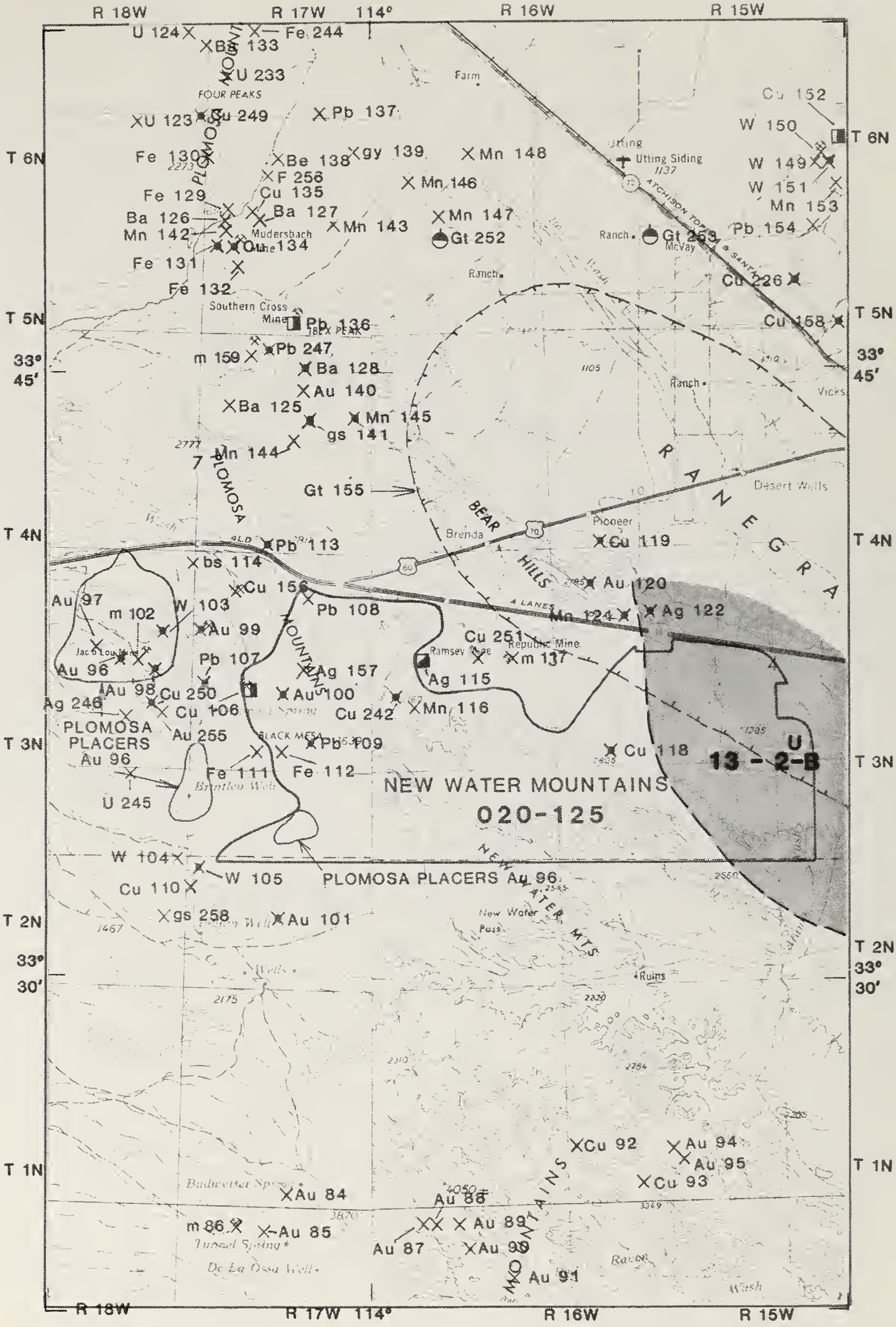


FIG.17 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR URANIUM RESOURCES OF THE BRENDA SUB-AREA, ARIZONA.

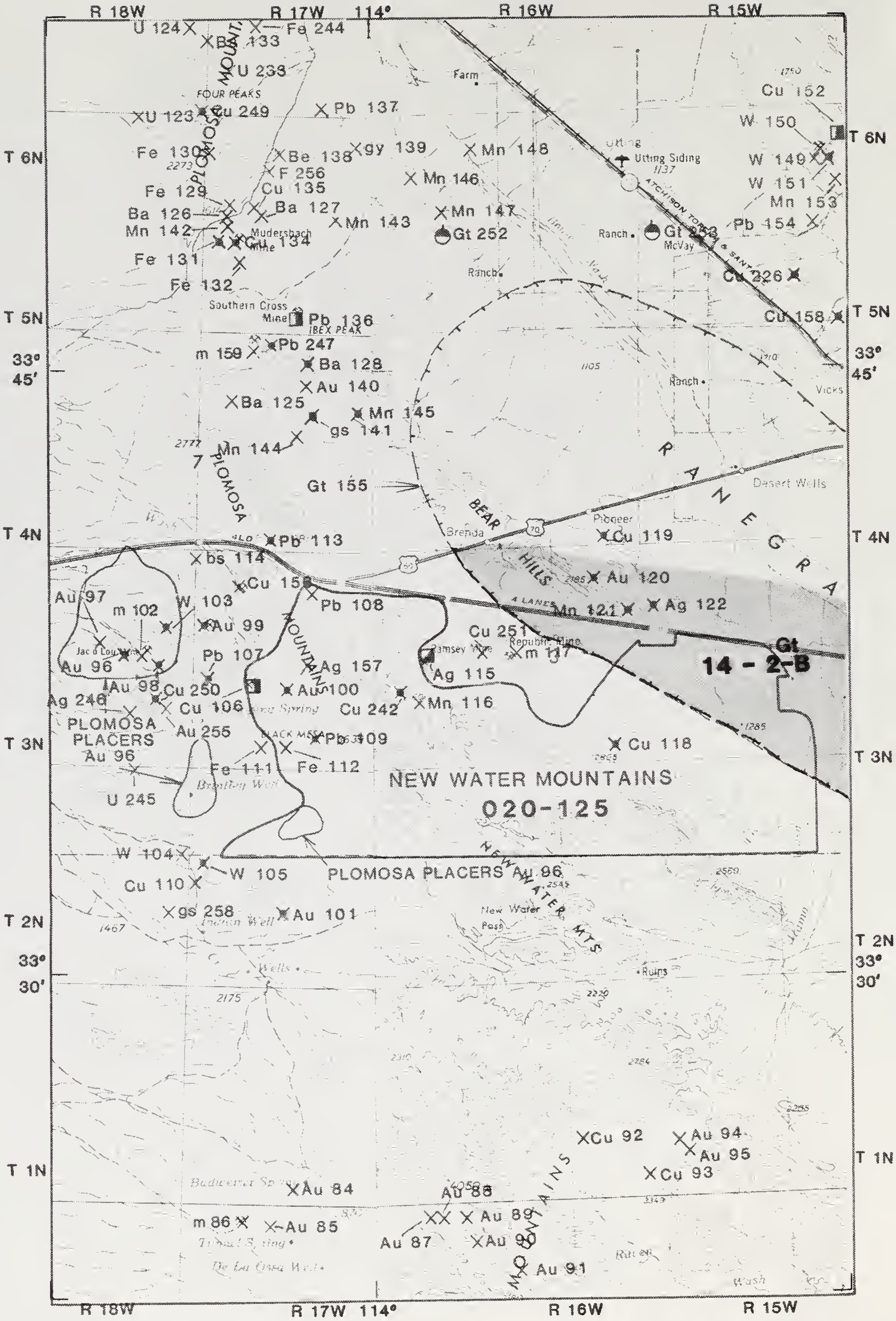


FIG.18 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR GEOTHERMAL RESOURCES OF THE BRENDA SUB-AREA, ARIZONA.

Recommendations

For Area 9, it is recommended that:

a) The pluton and surrounding country rocks should be field checked for presence of extensive hydrothermal alteration.

b) The intrusive rock and hydrothermal minerals associated with nearby ore deposits should be radiometrically dated to check whether they are coeval and genetically associated.

For Area 10, it is recommended that Mesozoic sedimentary rocks be field checked for the presence of favorable conditions for the formation of red-bed-type copper-silver deposits. For instance, check for the presence and location of red bed facies, reducing environments, evaporites, or mineral occurrences that might be of the red bed type.

For Area 11, it is recommended that the area be field checked to determine whether the Ramsey Mine mineralization extends into the WSA.

For Area 12, it is recommended that:

a) The area be field checked for the presence of extensive hydrothermal alteration.

b) The area be field checked for possible presence of cauldrons or intrusive centers which might be associated with mineralization.

For Area 13, it is recommended that:

a) The area be field checked for presence of uranium source rocks, aquifers, and reductants.

b) Available wells should be sampled and analyzed for uranium, fluoride, phosphate, carbonate, potassium, calcium, vanadium, Eh and pH, and the solubility index calculated for each sample.

Little Horn Mountains West WSA (020-126A)

Physiography

The WSA lies within the Little Horn Mountains. In the south, the mountains are steep-sided and flat-topped, being capped by basalt. In the north, the topography slopes towards the Ranegras Plain. The maximum relief in the WSA is about 1,000 feet (Figure 5).

Geology

The area is underlain by undifferentiated Tertiary volcanics and Tertiary basalt. The basalt crops out at higher elevations and is probably the younger unit. The undifferentiated volcanics to the south of the WSA contain andesite and rhyolitic and dacitic breccia.

Mineral Deposits

No mineral deposits are known to be present in the WSA. However, several mines and occurrences are found in undifferentiated Tertiary volcanics to the south of the WSA. The most noteworthy of these is the Sheep Tank Mine (160) which produced 120,000 tons of gold and silver ore between 1926 and 1933. Other elements present in anomalous concentrations include: Cu, Pb, Mn, and Ba. Minerals present include: galena, barite, pyrolusite, limonite, and chrysocolla. The presence of oxidized minerals suggests that a sulfide-rich zone may be present at depth. The mineralization is along a fault in Tertiary rhyolitic and dacitic breccia which has been intruded by diorite porphyry. Also present to the south of the WSA are two gold-silver prospects (164, 165) which occur together with Fe, Mn, and Hg in veins in volcanic flows, and two manganese prospects (161, 162) which contain pyrolusite and psilomelane along shear zones in andesite.

Land Classification for GEM Resources Potential

Metallic Minerals - The east-central part of the WSA (Area 15) is considered to have low favorability at a confidence level of B (Figure 19). The reasons for this classification are as follows:

a) There are no known occurrences in this area, however,

b) This area is underlain by undifferentiated Tertiary volcanics, and

c) Similar rocks to the south of the WSA contain significant Au, Ag, and Mn mineralization.

Recommendations

For Area 15, it is recommended that:

a) The area should be field checked for the presence of extensive hydrothermal alteration.

b) The area be field checked for the possible presence of cauldrons or intrusive centers which might be associated with mineralization.

Little Horn Mountains East WSA (020-127)

Physiography

The WSA covers a diverse topography which includes part of the Little Horn Mountains in the west, the Ranegras Plain in the north, the Palomas Plain in the south, and several ranges of hills and valleys in the east. The

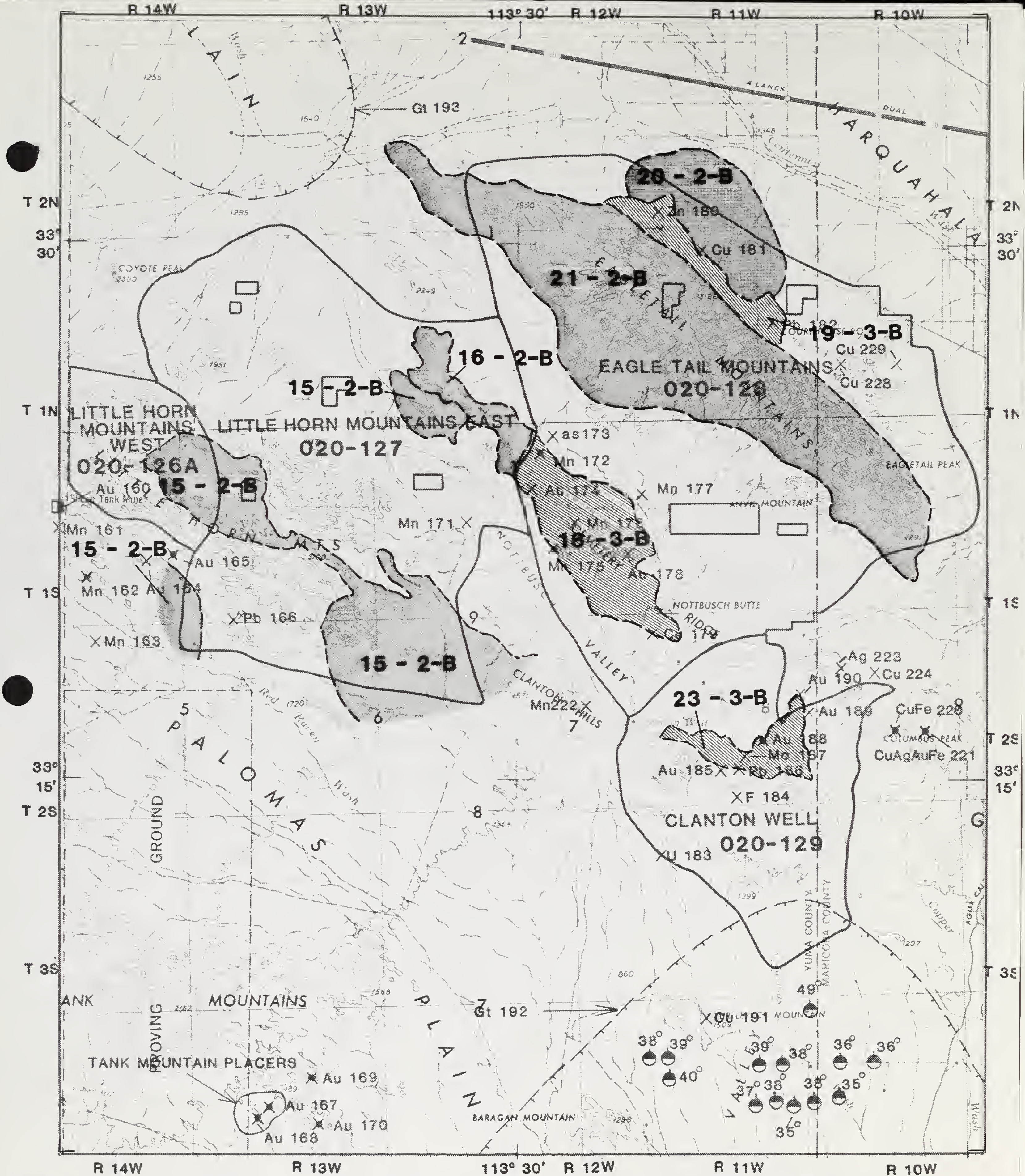


FIG19 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR METALLIC MINERAL RESOURCES OF THE EAGLE TAIL SUB-AREA, ARIZONA.

Little Horn Mountains are steep-sided and flat-topped and have a relief of approximately 1,600 feet. The hills in the eastern part of the WSA trend northwest and have a relief of 400 to 800 feet.

Geology

The area is underlain by Mesozoic metamorphic rocks, a possible Laramide intrusive, undifferentiated Tertiary volcanics, Tertiary basalt, and Tertiary sediments beneath the Ranegras Plain.

Little is known about the metamorphic rocks, except that to the southeast in the Eagle Tail Mountains WSA, they consist of schist, granite with schist inclusions, and gneissic granodiorite. In nearby areas, the undifferentiated Tertiary volcanics contain andesite, rhyolitic and dacitic breccia, and rhyolite porphyry. The basaltic rocks consist mainly of lava flows.

Mineral Deposits

Only two mineral occurrences are reported from the WSA: a lead occurrence and a manganese occurrence. Neither has been described and both are located in areas of basalt outcrop.

To the southwest, gold and manganese deposits occur in undifferentiated Tertiary volcanics and have been described above. To the east of the WSA, gold and manganese veins occur in Mesozoic metamorphic rocks that are intruded by Tertiary rholitic porphyry.

Land Classification for GEM Resources Potential

Metallic Minerals - The area underlain by undifferentiated Tertiary volcanics (Area 15) is considered to have low favorability at a confidence level of B (Figure 19). The reasons for this classification are as follows:

a) There are no known occurrences in the area, however,

b) The area is underlain by undifferentiated Tertiary volcanics.

c) Similar rocks nearby contain significant Au, Ag, and Mn mineralization.

The area underlain by Mesozoic metamorphic rocks (Area 16) is considered to have low favorability at a confidence level of B. The reasons for this classification are as follows:

a) There are no occurrences of metallic minerals in metamorphic rocks in this WSA, however,

b) A possible Laramide pluton intrudes the Mesozoic metamorphic rocks.

c) To the west, in the Eagle Tail Mountains WSA, several gold and manganese occurrences are present where the metamorphic rocks are intruded by Tertiary rhyolitic dikes.

Uranium - The area at the northern end of the WSA (Area 17) that is underlain by thick Tertiary sediments is considered to have a low favorability at a confidence level of B (Figure 20). The reasons for this classification are as follows:

a) There are no known uranium occurrences in or near the area, however,

b) There is a thick sequence (up to 3,200 feet) of late Tertiary basin-fill sediments and possibly mid-tertiary volcanics and sediments underlying the northern part of the WSA.

c) Volcanic rocks, which are possible sources of uranium, crop out on the margin of the basin. Few of them, however, appear to be rhyolitic in composition.

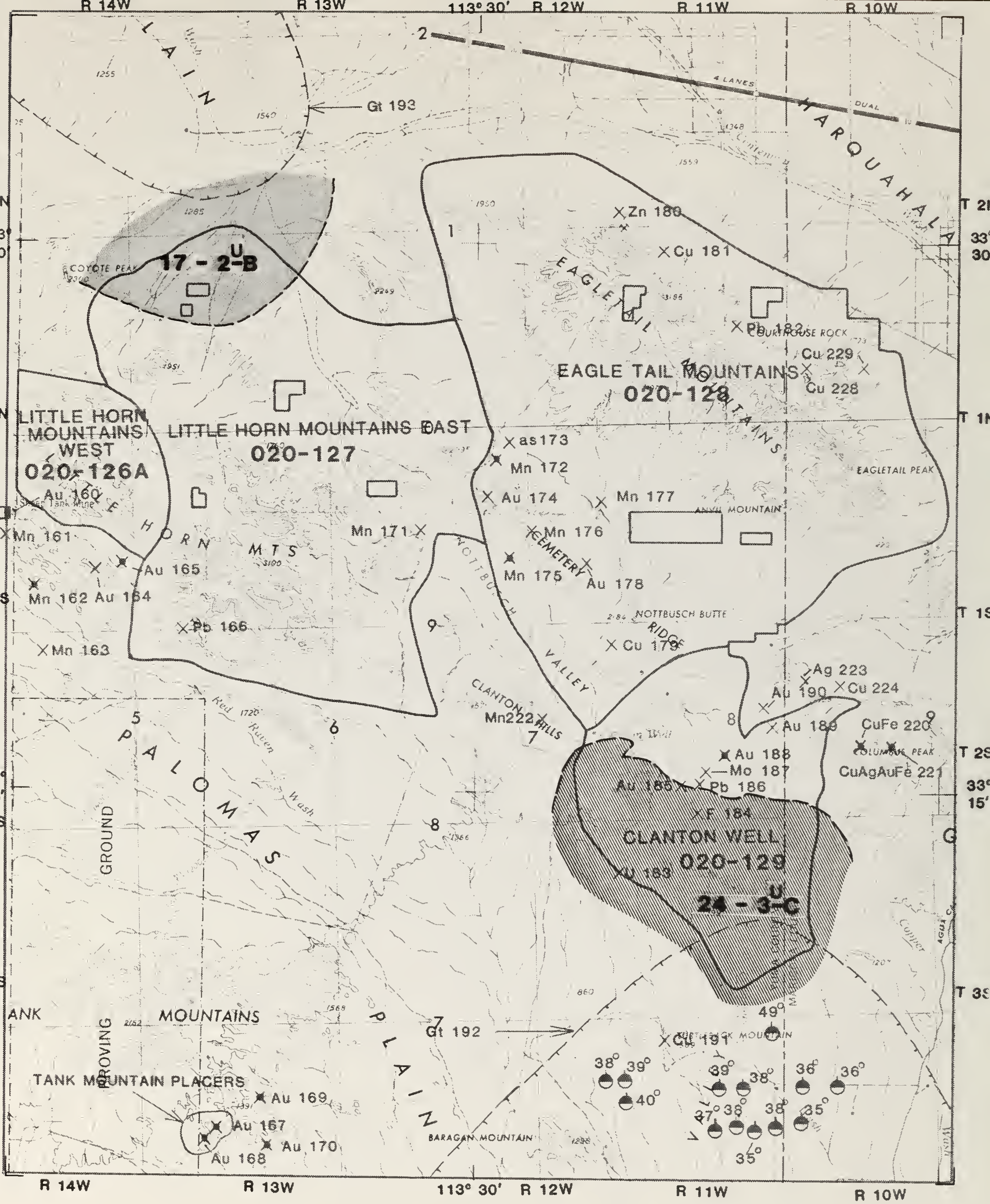


FIG.20 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR URANIUM RESOURCES OF THE EAGLE TAIL SUB-AREA, ARIZONA.

Recommendations

For Area 15, it is recommended that:

- a) The area be field checked for the presence of extensive hydrothermal alteration.
- b) The area be field checked for the possible presence of cauldrons or intrusive centers which might be associated with mineralization.

For Area 16, it is recommended that:

- a) The small Laramide intrusive be checked for the presence of extensive hydrothermal alteration.
- b) The area should be checked for the presence of centers of Tertiary rhyolitic porphyry with which gold and manganese mineralization may be associated.

For Area 17, it is recommended that:

- a) The area should be field checked for the presence of uranium source rocks, aquifers, and reductants.
- b) Available water wells should be sampled and analyzed for uranium, fluoride, phosphate, carbonate, potassium, calcium, vanadium, Eh and pH, and the solubility index calculated for each sample.

Eagle Tail Mountains WSA (020-128)

Physiography

The WSA encloses almost the entire Eagle Tail Mountains and the low-lying Cemetery Ridge to the south. The topography has a pronounced WNW to NW grain. The Eagle Tail Mountains are steep on the northeast, probably as a result of young faulting, and slope more gently to the southwest. They have a maximum relief of about 1,500 feet. The hilly topography to the southwest of the Eagle Tail Mountains has a relief of 200 to 600 feet.

Geology

The WSA is underlain by Mesozoic metamorphic rocks, Laramide intrusives, mid-Tertiary andesites and undifferentiated volcanics, and Quaternary-Tertiary basalts.

The Mesozoic metamorphic rocks along Cemetery Ridge consist of gneisses, schists, granite with schist inclusions, and gneissic granodiorite. The Laramide intrusives consist of medium-grained biotite diorite in which the biotite is partly chloritized (Shafiqullah et al., 1980). It differs from the two mica intrusions typical of Laramide stocks in southwestern Arizona. The basalts probably consist mainly of flows, the andesites of flows and breccias, and the undifferentiated Tertiary volcanics of a variety of rocks. A dike-like Tertiary intrusion of unknown composition forms the backbone of the Eagle Tail Mountains. Smaller rhyolite porphyry dikes intrude the Mesozoic metamorphic rocks in the Cemetery Hills.

Mineral Deposits

Mineral occurrences are located in undifferentiated Tertiary volcanics along the northeast front of the Eagle Tail Mountains and in the Mesozoic metamorphic rocks in the southwestern part of the WSA. In the former area, these base metal, gold, and silver veins (180, 181, 182) occur in shears. The shears cut the volcanics, and one of them (181) cuts a Laramide pluton, showing that mineralization is post-Laramide. The mineralization could be related to the intrusive dike which crops out along the west of the Eagle Tail Mountains. There is no known production from these occurrences.

In the southwestern part of the WSA, gold and manganese veins occur in metamorphic rocks that are intruded by Tertiary rhyolite porphyry dikes. Pyrolusite and psilomelane occur as stringers and veins in brecciated gneissic granodiorite (172) and in Tertiary volcanic breccia (175.1). Less than 100 tons of 22% Mn ore was produced in the early 1950s. Gold occurs in veins in a Tertiary granite dike (174) and along a fault between rhyolite porphyry and schist (178, 179). There has been no known production from these veins.

A deposit of amphibole asbestos of low quality occurs in Mesozoic metamorphic rocks (173). There is no known production.

Land Classification for GEM Resources Potential

The WSA is potentially favorable for the occurrence of metallic minerals and non-metallic minerals.

Metallic Minerals - The area underlain by Mesozoic metamorphic rocks and Tertiary volcanics in the southern part of the WSA (Area 18) is considered to have a moderate favorability at a confidence level of B (Figure 19). The reasons for this classification are as follows:

a) Several gold and manganese occurrences are present in Tertiary volcanic breccia and in the Mesozoic metamorphic rocks, especially where they are intruded by Tertiary rhyolitic dikes.

b) There are possible Mesozoic plutons (the gneissic granodiorite) in the area which could be related to an episode of Mesozoic mineralization.

c) Rhyolitic dikes in the area could be related to a nearby Tertiary intrusive center which could be related to mid-Tertiary mineralization.

The area underlain by undifferentiated Tertiary volcanics in the northeastern part of the WSA (Area 19) is considered to be moderately favorable at a confidence level of B. The reasons for this classification are as follows:

a) Three base metal and gold-silver occurrences are found in these rocks.

b) The volcanic rocks are close to a large Tertiary intrusive that may have been the source of metals and/or heat for the formation of these deposits.

The area underlain by Laramide plutonic rocks in the northeastern part of the WSA (Area 20) is considered to have low favorability at a confidence level of B. The reasons for this classification are as follows:

a) There are no known mineral occurrences in these rocks, except younger veins associated with mid-Tertiary events, however,

b) The rocks are somewhat altered.

c) They are Laramide in age and are fairly close to the northwest-trending belt of Laramide porphyry copper deposits (see Figure 2).

The area underlain by Tertiary andesites and Tertiary intrusive in the northeastern part of the WSA (Area 21) is considered to have low favorability at a confidence level of B. The reasons for this classification are as follows:

a) There are no known occurrences in this area, however,

b) Tertiary andesites are hosts to silver-lead deposits in other parts of the GRA.

c) The Tertiary intrusive rocks could be a source for hydrothermal fluids.

Non-Metallic Minerals - The area surrounding the asbestos occurrence (Area 22) is classified as having low favorability at a confidence level of B (Figure 22) because no production is recorded from this occurrence.

Recommendations

For Area 18, it is recommended that:

a) The area should be checked for centers of Tertiary rhyolitic porphyry intrusions with which gold and manganese mineralization may be associated.

b) The possible Mesozoic intrusive rocks should be checked for evidence of hydrothermal alteration that would be indicative of mid-Mesozoic porphyry copper-type mineralization.

For Areas 19 and 21, it is recommended that:

a) The intrusive and surrounding country rocks should be checked for presence of extensive hydrothermal alteration.

b) The volcanic rocks should be field checked for the possible presence of cauldrons which could be associated with mineralization.

For Area 20, it is recommended that:

a) The intrusive rocks should be checked petrographically to determine whether they are similar to Laramide plutons associated with porphyry copper deposits.

b) They should be field checked to determine whether there are any areas of intense hydrothermal alteration.

c) The hydrothermal alteration should be radiometrically dated to determine whether it is of Laramide age.

For Area 22, it is recommended that the size and quality of the reported asbestos occurrence be checked.

Clanton Well WSA (020-129)

Physiography

The WSA covers hilly terrain in the north and a gently, south-sloping surface in the south. The hills have a WNW trend and a relief of about 400 feet. The south-sloping surface extends into the Palomas Plain and Hyder Valley to the south.

Geology

The area is underlain by Precambrian metamorphic rocks and Tertiary volcanics and sediments. The Precambrian rocks lie to the northwest of the southwest projection of the Holbrook Line and may be related to the Yavapai Series, rather than to the Pinal Schists. The Precambrian rocks consist of schist and, according to Scarborough and Wilt (1979), gneissic granite.

The Tertiary volcanic and sedimentary rocks have been examined in some detail by Scarborough and Wilt (1979). The rocks consist of rhyolite flows and plugs; rhyolitic unwelded, ash-flow tuffs; both tuff and explosion breccias; andesite flow breccias; well-sorted, red-brown arkosic sandstone interbedded with mudstone; grey limestone and medium green sandstone; and basaltic andesite flows. The area has been intensely block faulted.

Mineral Deposits

Three gold veins (185, 188, 189), one lead (186), and one molybdenum (187) vein are present in Precambrian schist which is intruded by Tertiary andesite dikes. There was small production from one of the gold-bearing veins (188). A fluorite vein (184) with no recorded production occcurs in a Tertiary intrusive rock. A uranium occurrence with no recorded production is located on the southwest border of the WSA (183) and is probably located in Tertiary sediments. Low-temperature geothermal water wells are located a short distance to the south of the WSA.

Land Classification for GEM Resources Potential

The WSA is potentially favorable for the occurrence of metallic, uranium, non-metallic, and geothermal resources.

Metallic Minerals - The area underlain by Precambrian rocks (Area 23; Figure 19) is considered to be moderately favorable at a confidence level of B. The reasons for this classification are as follows:

a) Five gold, lead, and molybdenum occurrences, one with some reported production, are present in the area.

b) Tertiary intrusive rocks of andesitic and rhyolitic composition are present in the area.

c) The Precambrian rocks could be related to the Yavapai Series and, as such, might have potential for massive sulfide deposits.

Uranium - The area underlain by Tertiary rocks in the southwestern half of the WSA (Area 24) is considered to be moderately favorable at a confidence level of C (Figure 20). The reasons for this classification are as follows:

a) One uranium occurrence is located on the boundary of the WSA.

b) Rhyolitic source rocks are abundant.

c) Permeable sandstones are abundant.

d) Dark limestones are possible reductants.

e) A low-temperature geothermal field is located under the southern part of the WSA. This geothermal water could be sufficiently reducing to precipitate uranium.

Geothermal - The southern part of the WSA (Area 26) is classified as moderately favorable for a low-temperature geothermal field at a confidence level of C (Figure 21). The reasons for this classification is that a short distance south of the WSA boundary, thirteen wells contain water with temperatures between 35° and 49°C.

Non-Metallic Minerals - The area surrounding the fluorite occurrence

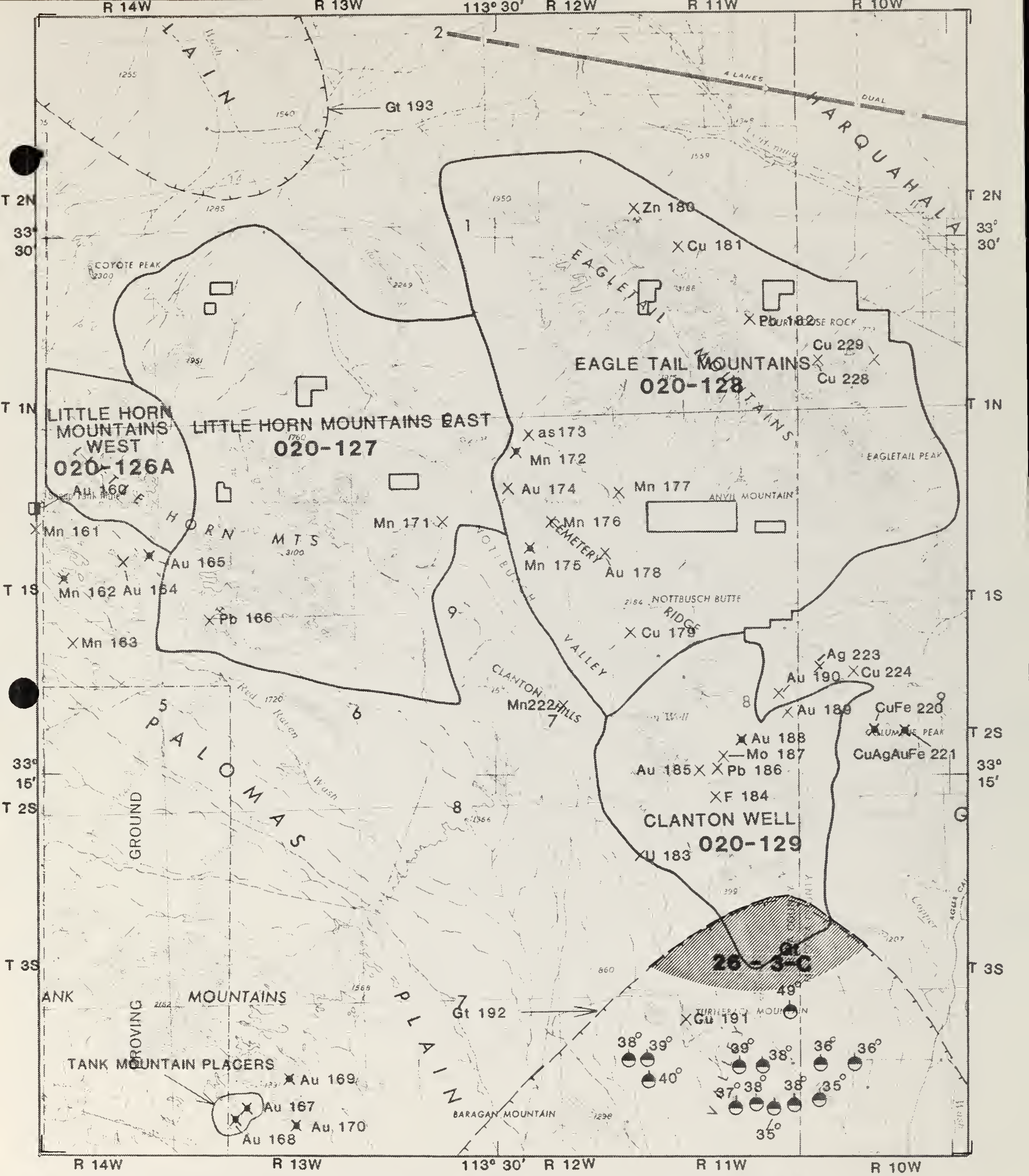


FIG.21 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR GEOTHERMAL RESOURCES OF THE EAGLE TAIL SUB-AREA, ARIZONA.

(Area 25) is considered to be moderately favorable for the occurrence of fluorite at a confidence level of B (Figure 22). The reasons for this classification are as follows:

a) A fluorite occurrence is present in the area.

b) The occurrence appears to be related to a Tertiary intrusive.

Recommendations

For Area 23, it is recommended that:

a) The Precambrian rocks should be examined in the field to determine whether any metavolcanic rocks are present, and if so, whether there are any indications of the presence of massive sulfide deposits.

b) This area and adjacent volcanic areas should be examined in the field for the presence of Tertiary intrusive centers or cauldrons.

c) This area and nearby volcanic areas should be examined for the presence of extensive hydrothermal alteration.

For Area 24, it is recommended that:

a) The area be field checked for the presence of uranium source rocks, aquifers, and reductants.

b) Available wells should be sampled and analyzed for uranium, fluoride, phosphate, carbonate, potassium, calcium, vanadium, Eh and pH, and the solubility index calculated for each sample.

Face Mountain WSA (020-136)

Physiography

The WSA encloses all of Face Mountain and some of the surrounding

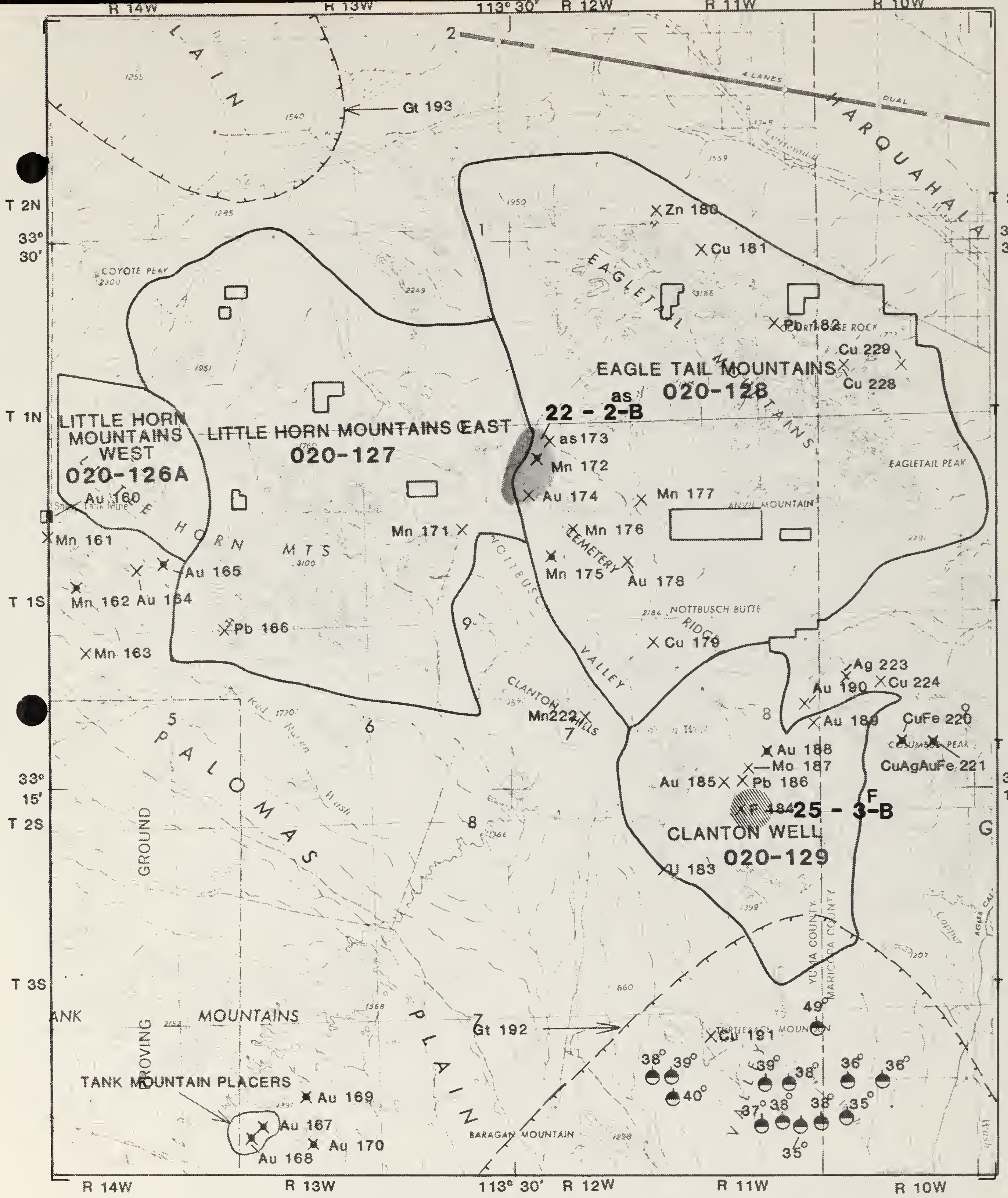


FIG.22 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR NON-METALLIC MINERAL RESOURCES OF THE EAGLE TAIL SUB-AREA, ARIZONA.

lowlands. Face Mountain steeply rises about 1,200 feet above the surrounding lowland (Figure 6).

Geology

The WSA is underlain by Precambrian gneisses, Tertiary volcanics and sediments, and Tertiary-Quaternary basalts. According to Scarborough and Wilt (1979), the Precambrian rocks consist of foliated granodiorites. The Tertiary rocks (shown as andesite on map) consist of red-brown arkosic sands with interbedded silicic tuffs, ash-flow tuffs, and dark fetid limestone and gravel with gneissic granite pebbles (Scarborough and Wilt, 1979). This sedimentary sequence lies in fault-angle depressions between uplifted Precambrian gneiss. The Quaternary-Tertiary basalt consists mainly of flows. No deep late Tertiary basins underlie the WSA.

Mineral Deposits

One lead occurrence (197) with no known production, and two undefined mineral occurrences (195, 196) are located within the northern part of the WSA in Precambrian gneiss. Just outside of the northwestern boundary of the WSA, Tertiary fetid limestone registers twice background radioactivity.

Land Classification for GEM Resources Potential

Uranium - The Tertiary rocks in the northern part of the WSA (Area 27) are considered to have low favorability for the occurrence of uranium deposits at a confidence level of B (Figure 24). The reasons for the above classification are as follows:

a) A slight radioactive anomaly is located just outside the WSA.

b) The rhyolitic tuffaceous rocks are potential source rocks for uranium.

c) Permeable sandstones are present in the area.

d) The fetid limestones may be suitable reductants for uraniium.

Recommendations

In Area 27, it is recommended that:

a) The area should be field checked especially for presence of reductants.

b) Available wells should be sampled and analyzed for uranium, fluoride, phosphate, carbonate, potassium, calcium, vanadium, Eh and pH, and the solubility product calculated for each sample.

Signal Mountain WSA (020-138)

Physiography

The WSA encloses a hilly area long the crest of the Gila Bend Mountains, where the maximum relief is about 600 feet. In the south, the WSA extends into the Dendora Valley (Figure 6).

Geology

The WSA is underlain by Precambrian schist, mid-Tertiary andesite, minor sediments, and Tertiary-Quaternary basalt. The Precambrian schists lie approximately on the southwest extension of the Holbrook Line and could either be related to the volcanogenic Yavapai Series or the non-volcanogenic Pinal Schists. The mid-Tertiary andesites probably consist of flows and breccias and may be interlayered with sedimentary rocks as described for the

Face Mountain WSA. The Tertiary-Quaternary basalts probably consist mainly of flows.

Mineral Deposits

No mineral occurrences are located within the WSA. However, two copper occurrences (206, 207) and one bismuth occurrence (209) are located near the northern end of the WSA in Precambrian schist. There is no reported production from these occurrences, and information about their geology is lacking.

Land Classification for GEM Resources Potential

Metallic Minerals - The area underlain by Precambrian schist at the north end of the WSA (Area 28) is considered to have low favorability at a confidence level of B (Figure 23). The reasons for this classification are as follows:

a) No occurrences are present in this area, however,

b) Two copper and one bismuth occurrence are located in Precambrian schist just outside the WSA boundary.

c) The schists could be part of the Yavapai Series and thus be a favorable location for massive sulfide deposits.

The remainder of the WSA is considered unfavorable for metallic mineral deposits at a confidence level of B because of the total absence of known mineral occurrences.

Recommendations

For Area 28, it is recommended that the area be field checked for the possible presence of metavolcanic rocks and associated massive sulfide deposits.

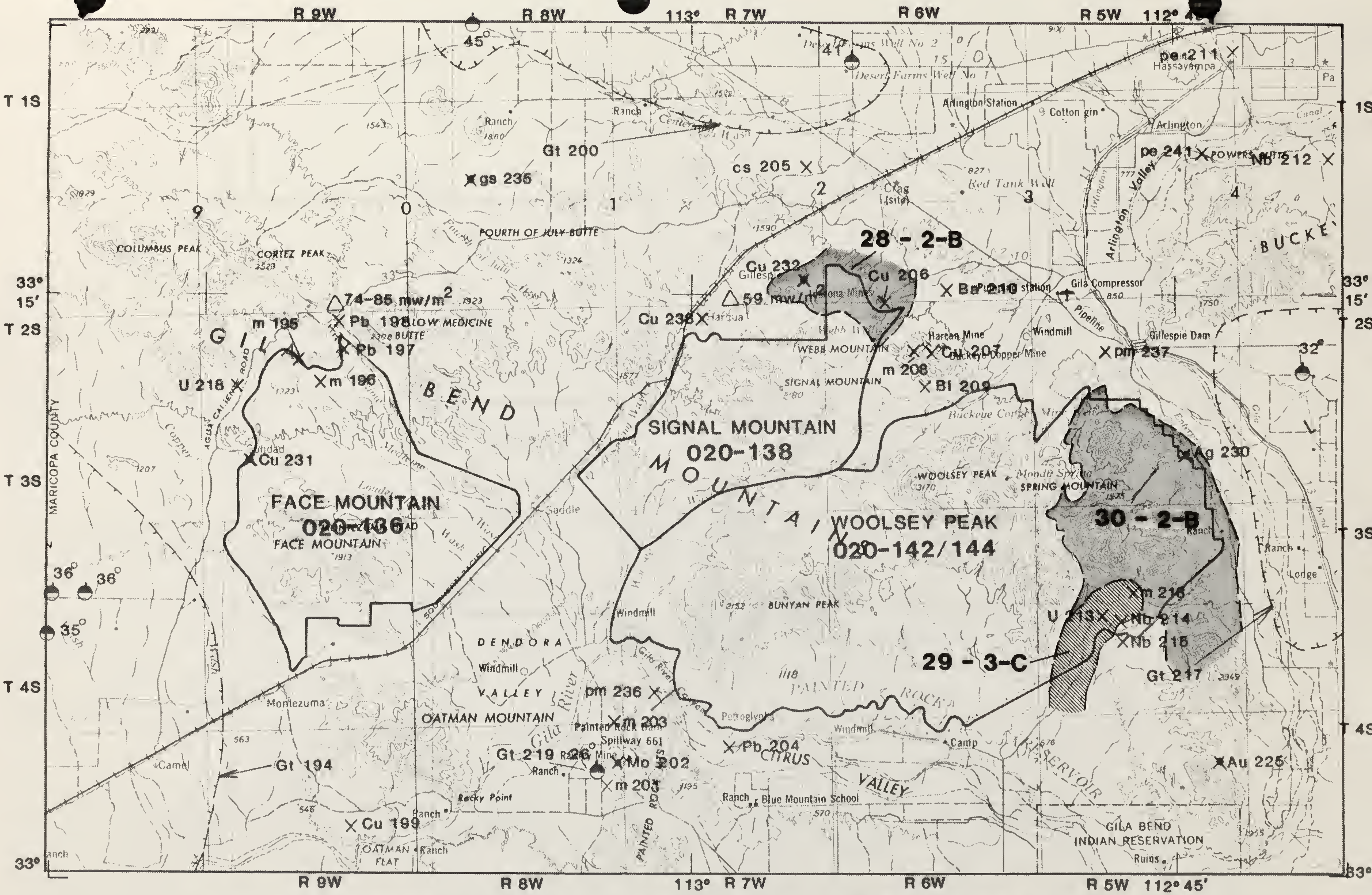


FIG.23 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR METALLIC MINERAL RESOURCES OF THE SADDLE SUB-AREA, ARIZONA.

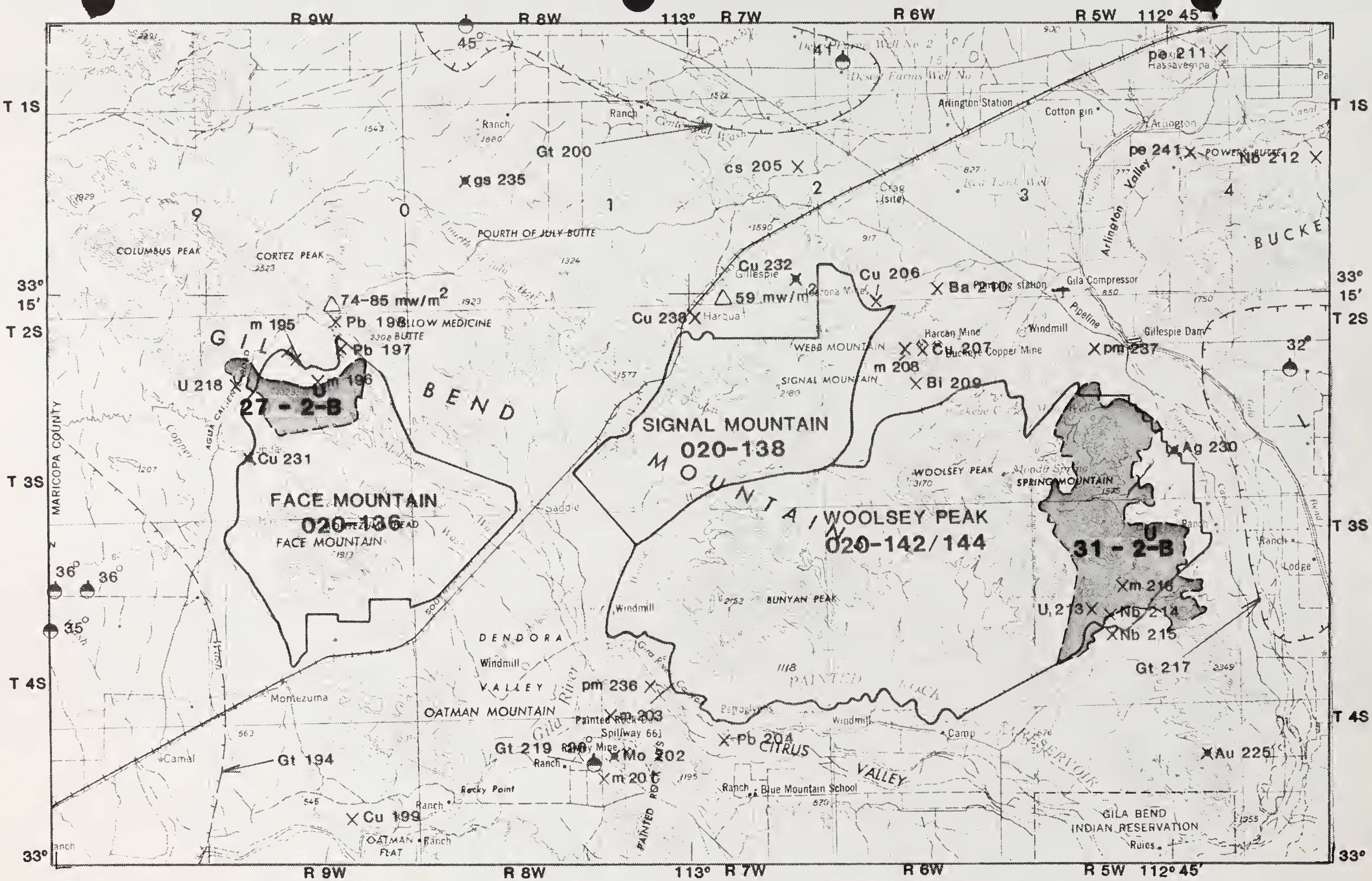


FIG. 24 FAVORABILITY POTENTIAL AND LEVEL OF CONFIDENCE MAP FOR URANIUM RESOURCES OF THE SADDLE SUB-AREA, ARIZONA.

Woolsey Peak WSA (020-142/144)

Physiography

The WSA lies in the eastern part of the Gila Bend Mountains, and in the south, extends into the Gila River Plain. The Gila Bend Mountains are steep and have 1,000 to 2,000 feet of relief (Figure 6).

Geology

The WSA is underlain by Precambrian granite, mid-Tertiary andesites and sediments, and Quaternary-Tertiary basalts.

The Precambrian granites probably comprise part of the 1.5 to 1.3 b.y.B.P. anorogenic series of granitic to quartz dioritic intrusives common in southern Arizona. The Tertiary andesites probably consist of flows and breccias, likely interlayered with sediments, as described for the Face Mountain WSA. The Quaternary-Tertiary basalts consist mainly of flows.

Mineral Deposits

Two deposits containing tantalum and niobium (214) and uranium (213), respectively, are located in the southwest corner of the WSA. Both occur in pegmatites within the Precambrian granites. The uranium-bearing pegmatite contains davidite and the tantalum- and niobium-bearing pegmatite contains samarskite and fergusonite and is enriched in Ta, Y, U, Th, Ti, Pb, and Ag. Just beyond the WSA boundary, a samarskite-fergusonite placer deposit is located in recent gravels. No production is known from any of the above occurrences.

Land Classification for GEM Resources Potential

The WSA is potentially favorable for the occurrence of metallic and uranium mineral deposits.

Metallic Minerals - The area close to the niobium-tantalum occurrences and underlain by Precambrian granite and recent alluvium (Area 29) is considered to be moderately favorable for occurence of Nb-Ta deposits at a confidence level of C (Figure 23). The reasons for this classification are as follows:

a) Fergusonite and samarskite occur in a pegmatite in this area.

b) Both the above mentioned minerals have been concentrated in recent alluvium nearby.

The remainder of the Precambrian granite outcrop and nearby alluvium (Area 30) is classified as having low favorability at a confidence level of B because of its geological similarity to Area 29.

Uranium - The area overlying Precambrian granite in the eastern part of the WSA is classified as having low favorability for uranium deposits at a confidence level of B (Figure 24). The reasons for this classification are as follows:

a) A davidite-bearing pegmatite is located in the area, however,

b) Economic deposits of uranium in pegmatites are not common.

Recommendations

It is recommended that Area 29 be examined in the field to determine size and extent of niobium-tantalum and uranium mineralization.

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